JUL 3 1911

TELEPHONE ENGINEER

Vol. VI CHICAGO, JULY, 1911 No. 1

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CHICAGO, JULY, 1911.

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CHEAP SERVICE.

SOME of the Hearst newspapers recently contained an editorial on cheap telephone service. The inspiration came from a report in the New York *Times* that J. O. Armour, the Chicago packer, is back of a plan to make telephone competition in New York City by establishing an independent automatic plant in the metropolis. It is understood, of course, that the rates of such a system would be lower than those of the existing manual system.

As proof that the automatic system could actually do the thing suggested, the new Chicago system is pointed to—and back of it is this same Armour and his associates. And the Chicago system may be called actually established permanently. If any doubt it, the leading story in these pages this month should convince them. The automatic is here, whether the manual operators like its competition or not. And what has been done in Chicago could doubtless be done in New York.

So we have no quarrel with the Hearst editorial writer on that score. But we do object to some of his conclusions on the subject of rates—particularly on the subject of cheap rates. We will have to quote him to make our point clear:

The idea of cheap telephone service is going to grow in the United States, and eventually it is going *to be realized*, despite the power of any monopoly or the profits of any group of individuals.

It costs less, or under proper management *would* cost less, to send a telephone message than to send a letter.

There was a time in the United States when private individuals exploited the mails and when the citizen writing a letter paid from ten cents to a dollar or more to have it delivered. Government ownership, economical, businesslike methods, have reduced the price of sending letters to two cents all over the United States—even in the Klondike, where the letters are carried on dog sledges.

And sane, businesslike administration of the telephone system of this country, with the latest up-to-date automatic methods, would make telephoning as cheap as writing letters, and cheaper.

That will not come at once, *but a very great improvement will come, and right away.*

The price charged by the Bell monopoly is preposterous—there is no worse form of extortion among all the extortions in the United States

A man who lives in the suburbs thirty miles from a big city gets a commutation ticket. The railroad carries his two-hundred-pound body back and forth twice a day for twenty-five cents a day. If he wants to talk to his house twice a day *the telephone company charges him sixty cents*, and charges for the wire besides.

In other words, the telephone monopoly charges more than twice as much to carry over a wire a human voice, which weighs nothing, as the railroad charges to carry a two-hundred-pound man over thirty miles of solid steel rails.

And the railroad has to have terminals, and locomotives, and power; whereas, with the telephone, the man's own voice is the chief power involved.

The editorial is simply written, as befits an address to the "common people." One cannot avoid the conclusion, indeed, that it was not only simply written, but simply conceived. Surely a little meditation would have revealed the illogicalities of some of the arguments so boldly set down.

It is easy to parallel telephone service with railroad service and postal service for the edification of the people. The operation is justified from the newspaper standpoint because it is correct in superficial appearance. But there, unfortunately, the resemblance to truth ceases.

In the first place, back and forth over a thirty-mile railroad track—sixty miles—for twenty-five cents is remarkably cheap railroading for a two hundred pound man, even with a commutation ticket. And on the other hand, there is no reason in the world for comparing a round trip on the railroad to *two* telephone calls. Each telephone conversation is a complete round trip in itself—or at least telephone talk usually travels both ways. That cuts the Hearst argument in half. And the telephone company does not charge for the wire besides. If the man mentioned objects to paying monthly rentals on a telephone, he can go to a public pay station and call up his home at just the toll charge.

We must admit that a man's body weighs very, very much more than his voice. On that basis, indeed, it would seem that the telephone company must transmit the voice for nothing. But, on the other hand, we might find that that same railroad would transport a ton of soft coal a great deal farther for twenty-five cents than it would carry the two hundred pound man.

Now there are several ways in which a two hundred pound man can be carried. He can ride on the railroad, he can use an automobile, he can hire a horse, or pedal a bicycle, or even make his legs carry him. His thirty-mile jaunt can cost him all the way from nothing up to several hundred dollars. But there is only one means of carrying his voice, and that means is the telephone.

Each train that the two hundred pound suburbanite travels on carries, presumably, several hundred other suburbanites at the same time. The only thing he has exclusive use of is the half-seat he occupies. Numerically he is comparable to one word in a telephone conversation. The total cost of transporting the train, including depreciation of equipment and interest on investment, is divided among the several hundred simultaneous users. This does not take into account, remember, the other similar trains running on the same railroad. But the telephone system gives to this same user the exclusive use of thirty miles of double wire, two or more (probably more) complicated cord circuits and other switchboard parts, and the services of several operators—a sort of private car to carry his voice, with a train crew to minister to his wants. If it were possible to send several hundred voices over the same wire simultaneously—a sort of infinite refinement of Major Squire's experiment—the charge per voice might be very much smaller than the railroad charge per passenger. And this in spite of the fact that it is technically much easier to transport a two hundred pound man than to transmit a voice.

The railroad has to have terminals, and locomotives, and power; but the editorial writer obviously does not know what a telephone system has to have. Doubtless his conception of an exchange is simply a place where wires are temporarily joined together by girls. His idea of an automatic exchange, then, must be the same thing with the girls left out. He can see little expense attached to the manual system, and none at all to the automatic. So he pronounces present charges on the manual system extortionate and predicts that under the automatic regime telephoning will cost less than postage. He forgets that Uncle Sam can throw a thousand letters into a bag and carry a thousand bags on a train, so that the cartage cost per letter is infinitesmal, while telephone service, automatic or manual, is always personal and exclusive.

Considerable harm is done by newspaper editorials of this superficial sort. They are unquestionably read by the public, and considerable faith placed in their contentions. The result in a case like this would be not only dissatisfaction with present service, but expectations for future service that can never be met.

If Armour builds in New York and can make lower rates than the present system, well and good. But don't tell the people that his system will give service for a cent a call, or cheaper than postage, or at a fraction of present rates, etc. He may not intend to do any such thing. Even automatic plants have running expenses, and cannot give service for nothing, nor for just the interest on investment. Good service is worth all that is being charged for it. Let the company earn a living.

OHIO'S PUBLIC UTILITY BILL.

OHIO'S public utility bill, with many of the amnedments that were eliminated by the senate restored by a conference committee, became a law last month without Governor Harmon's signature. At last the telephone interests of the state have something to work on, and we may expect an immediate resumption of activities in "the Ohio situation."

The most interesting section of the bill, and the particular thing that the telephone people have been waiting for, is the one providing for the consolidation of telephone companies. Two or more companies whose properties lie within or partly within the state, when they have complied with the orders of the commission and the requirements of the act, may consolidate. Such companies must file a joint petition in which all the details of the terms must be set forth. If, after hearing, the commission is satisfied that consolidation will be of public advantage and convenience and that adequate service will be furnished at reasonable rates, it shall make an order of consolidation. No consolidation shall be valid until after the commission has ascertained the value of the properties concerned, and upon this valuation all charges must be based.

Telephone companies may also be required to connect their lines in order to give a continuous service between localities. Joint use of equipment may be required to accomplish this purpose, but at all times the tolls for joint service must be reasonable, and the commission shall have power to apportion charges among the companies.

That consolidations will result from this act cannot be doubted. It is the avowed purpose of the Bell Company to absorb and merge with its own system the better independent properties "wherever it can be legally done, and done with the acquiescence of the public." The Ohio bill affords the legal permission in that state, and the acquiescence of the public is merely the judgment of the commission. There is good evidence also that some of the Ohio independents

are ready to negotiate. Cleveland, Columbus and Toledo will probably be the first to consummate a merger.

Before the advent of the public service commission a telephone consolidation usually meant an open field for the organization of a new company. The Ohio law, however, has placed a guard at that opening. Before a telephone company can establish an exchange on a permit or franchise granted before this act was passed, but not yet exercised, or on any permit or franchise granted in the future in a municipality that already has service, it must secure from the commission a certificate that the plant is necessary to the public convenience. In other words, the promoters of a new telephone company must actually create sufficient demand for a second service to influence the commission favorably.

Other powers and functions of the Ohio commission are of the usual order. The body has jurisdiction over quality of service, rates, accounts, contracts, bond issues, etc. The sum of $75,000 per year is appropriated for the support of the commission, and in addition fees may be charged for testing subscribers' meters, for copies of papers and other services.

Any company dissatisfied with commission rulings may appeal to the common pleas court of Franklin county or the county wherein the principal office is located, to set aside the order as unreasonable and unjust. The order of the commission shall continue through such proceedings, however, unless the company shall elect to operate under the rates or rules in force for the period next preceding the issue of new rates or orders, when bond shall be given for the protection of patrons in case the commission is sustained by the court.

FARMER LINES IN ENGLAND.

WHY there should be any particular difference between the daily needs of the British farmer and the parallel requirements of the agriculturist on United States soil does not appear. A difference there must be though, or else ridicule inspired in England by the British postmaster-general's proposal to give the farmers $15 telephone service is distinctly inapropos. As an example of the general attitude, we quote from a recent editorial in the London *Electrical Engineer:*

> The *parturiunt montes* and the *ridiculus mus*—the postmaster-general and his £3 telephones for farmers. When Mr. Herbert Samuel, in the course of his post office statement in the House of Commons, began to speak of his great plans for developing the uses of the telephone, there seemed to be a momentary foreshadowing of something intended to redeem the telephone situation. When, however, he outlined his scheme there was frank disappointment among his personal champions. For, after all, what does it amount to? To give the farmers the benefit of the telephone system when, for instance, there is a sudden dearth of potatoes or mangel-wurzel, it is necessary for five of their number to club together and pay the post office an aggregate of £15 per annum for the use of a five-party line. Those who have had experience of party lines will not need to be told that this is a very doubtful boon, and in the case of the farmer has not even the merit of cheapness. The fact that the service is to be unlimited seems at first sight to be something of a concession, but when it comes to be analyzed there is little enough in it. In the nature of the case the farmer is very unlikely to need more than the message rate limit of 360 calls per annum, and would probably not need at the outside more than 100 calls a year. This works out at 7¼d. (14½ cents) per call for each farmer. If he had 150 calls it would cost 4¾d. (9½ cents) per call, while 200 calls would cost 3¾d. (7½ cents) each, and one call a day for each working day of the year would come out at 2½d. (5 cents) per call. The postmaster-general says nothing about the distance limit, but from the general tenor of his observations it seems fair to assume that the usual inflexible limit of two miles will be in force; and those who know anything of distances in agricultural districts will readily realize that if the farmer has to pay trunk rates for calls at a distance exceeding that limit, his £3 party-line telephone is not likely to be such a blessing as Mr. Samuel anticipates.

Since the consummation of the British government's plan to take over the telephone system of the country, it has become quite the thing for its engineers to investigate American methods and practice. Most of these visitors have professed admiration for the celerity with which telephone calls are handled on this side, and for the general ubiquity and importance of our telephones. We even believe these investigations may benefit the English service, for the British telephone engineers are among the best in the world, and it is not their fault that their system is second to our own.

But these engineers, when they visited us, studied our service only in the cities. This was natural enough; visitors to a foreign country always keep to the beaten paths. So they did not learn, and do not now realize, that the present remarkable telephonic development of this country is due largely to the farmer.

Not so very many years ago England's farmer telephone project would have met the same reception here that it has there. But perhaps our farmers were more aggressive and insistent than those of England. The big companies refused them service because such service would be unprofitable to the operators. So the farmers organized their own companies, cut their poles, strung their wires, installed their supply house instruments. In this labor they were encouraged and assisted by the independent manufacturers of telephone apparatus. That is why today, even in the remotest districts, you can scarcely find a farm house without its telephone connection.

The American Telephone and Telegraph Company's report for 1910 gives a total of 1,852,051 telephones operated by local co-operative and rural companies or associations—farmers' lines, in other words—having connection with Bell lines. This does not take into account the vast number of such systems which are either isolated or which have connection only with independent companies. This is a formidable display of telephone strength for a class which, in England, seems to receive only ridicule.

Today in this country the largest operating telephone companies are reaching out to the farmer—building lines into his remote districts, offering him service at such prices that he cannot afford to be without a telephone. They are doing this even if the farm line rates spell a loss on every installation; for the farmer's telephone is a most efficient feeder to the profitable business telephones of the buyer and seller in the towns.

And American telephones, it must be remembered, *are operated for profit.* After this year English telephones will not be expected or required to make money. They will be operated by the people, for the people—or at least that is the theory of government ownership. If American operators find it actually profitable, though indirectly, to give the farmer the best possible service, how can the altruistic government-owned British system refuse to serve him similarly?

London's telephone rates, although a trifle complex from our viewpoint, are not widely different from

those of our own large cities. Nor is Mr. Samuel's proposed $15 farmer rate on a five-party line much at variance with ours. The *Electrical Engineer's* prediction as to the number of calls per telephone is either—with all respect to our contemporary—sophistry, or—as we said once before—the English farmer and the American farmer are different.

The proposal is to give the farmer a five-party line. We are informed by the English technical press that "those who have had experience of party lines will not need to be told that this is a very doubtful boon." In the face of this disparagement we almost hesitate to call the attention of our trans-Atlantic neighbors to the multi-party lines of our own rural districts. In the country even today it is common to put ten, twelve, even sixteen parties on a single line; while more than one early builder could speak—in whispers—of extraordinary lines strung in pioneer days with as many as thirty instruments. As a matter of fact, we have found ten-party farmers' lines quite satisfactory; and the English five-party farmer may consider himself well off.

Taken all in all, we cannot from this distance, perceive those flaws in Mr. Samuel's proposal which his confreres profess to see so plainly. Indeed, we are quite convinced that the five-party, fifteen dollar farmers' line will do more for the development of British telephony than many a more pretentious undertaking. After all, it is the "common people" who make the telephone what it is, and not the occasional user of the high-tolled long distance line.

LONG DISTANCE DEVELOPMENTS.

BY the use of "loaded phantom" circuits telephonic transmission has been accomplished between two points over two thousand miles apart. Furthermore, we have the promise of engineers that another thousand miles will be added to the long distance circuit within a few years. After what has been accomplished, we have no reason to doubt a further increase of efficiency of fifty per cent, or a hundred, or indeed anything within reason.

The annihilation of considerable distances by telephone transmission is attended by much stress. The two thousand mile message is not born without labor, though the public, which is the beneficiary, is not a witness to the travail. The user of the long line never knows the effort of the first message in preparing for the ease of those that follow.

Perhaps the day will come—nay, we may confidently expect it—when telephone currents will not be delicate, and we can bridge distance merely by increasing the power instead of by matching the currents with the delicacy of our apparatus and the nicety of our mathematics. Already the experimenters are giving us higher power transmitters and practical repeaters, and are bending Hertzian waves to the narrow confines of a wire for the improvement of telephone transmission.

Technical telephony is actually in its infancy—there is no doubt about that. We have not yet even sounded its possibilities. Yet all those wonders which are still hidden from us only emphasize the words of the present-day telephone engineer. The master workman is he who accomplishes the thing he sets out to do while his tools are inadequate and his materials almost too fragile for handling.

THE TELEPHONE EXPERT'S OPPORTUNITY.

ENGINEERS in all fields have always contended that their work was the least remunerative, expenditure of gray matter considered, of any. Technical brains, said some one, are the cheapest commodity on the labor market. And telephone engineers, far from being exceptions to the rule, have generally been inclined to feel that they were giving more than their share of uncompensated effort.

Events and evolutions of the last few years, however, have opened a number of new opportunities for the thoroughly equipped telephone engineer. The responsible cause for the change is the modern tendency of municipalities to regulate their public utilities, especially their telephone systems; and the creation of state utility commissions, rapidly becoming universal.

Commissions having jurisdiction over rates and service, whether they be municipal, state or national, are certain to be overwhelmed with appeals for help from both the served and the servers as soon as their functions are generally appreciated. It is certain that many users of telephone service will attempt to prove that they are being overcharged; and it is still more certain that many long-suffering telephone utilities will make strenuous appeals for higher rates as a life-saving measure. The justice of these claims the commissioners will have to decide.

To adjust telephone rates on a truly equitable basis requires investigation of the telephone property and consideration of all the tangible and intangible values with which only a telephone expert is familiar. Here, then, is one opportunity for the telephone engineer which previously existed, if at all, only on a very small order.

Municipal commissions created solely for investigation of a single system are especially good prospects for the telephone expert. There may even be opportunity for two or more telephone experts on one job; as witness the recent investigations in Chicago, Ill., and Wichita, Kan. In these cases the city council committees having the matter in charge, when dissatisfied with the findings of the first experts because they found that the operating companies were losing money, promptly employed other experts in the hope of more favorable reports.

The usual fee of a telephone expert so employed is very comfortable while it lasts, and goes far toward compensating him for any possible lack of pecuniary recognition in the past.

MARYLAND COMMISSION NOTES.

The Chesapeake and Potomac Telephone Company has petitioned the Maryland Public Service Commission for permission to purchase the stock of the Western Maryland Telephone Company, which operates in Allegany county. This action is opposed by the independent interests on the ground that it will cripple the service of the companies that compete with the Chesapeake and Potomac and which exchange business with the Western Maryland Company. The headquarters of the Western Maryland are in Cumberland. The Chesapeake and Potomac proposes to buy all the stock in advance of what it has been bringing on the market and to assume the bonded indebtedness, part of the payment to be made in stock of the American Telephone and Telegraph Company.

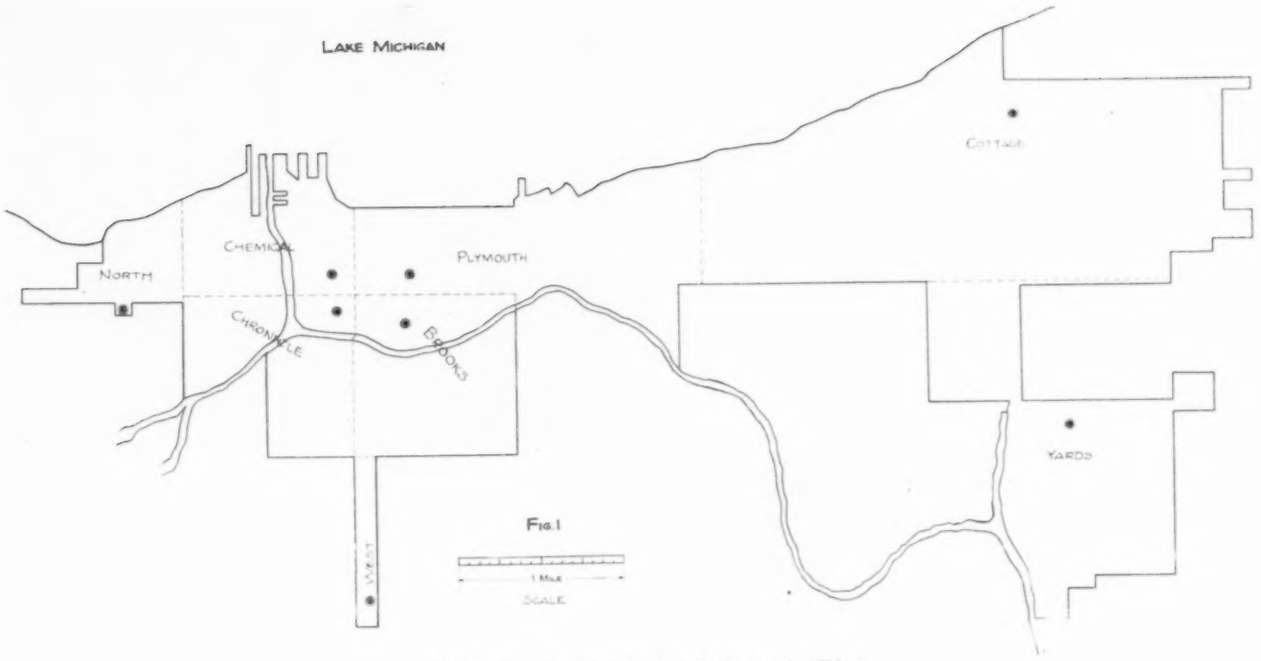


Fig. 1. Location of Automatic Exchanges in Chicago.

Features of Chicago's Automatic System

By C. M. Bradford

THE independent telephone system operated by the Illinois Tunnel Company in Chicago comprises eight offices, equipped with automatic switchboards. The map (Fig. 1) shows the size of the district which is covered by the system at present and which extends for over eight miles, embracing the stock yards and a large portion of the residence district on the south side, the business district of the loop and vicinity and reaching well into the residence district on the north side. The heavy dots surrounded by circles indicate the central office locations and the dotted lines denote the boundaries of the office districts.

The headquarters of the company and the principal office are in the Chronicle building, 175 Washington street. A second office is in the Brooks building at the corner of Jackson boulevard and Franklin street; a third in the Chemical building on Dearborn street just north of Washington, and a fourth office is at No. 19 Plymouth court. These four offices, one in each corner of the loop, serve the loop district and adjacent territory.

Fig. 2. Connector Switches at North Office.

North of the loop district is "North" office, situated at La Salle and Maple streets. The district west of the loop is served by "West" office at the corner of Monroe and Paulina streets. The territory south of the loop is served by two offices—one called the "Cottage Grove" office, situated at the corner of 39th and Elmwood, in the residence district along the lake; and the second office called "Yards" is located at the edge of the Stock Yards district at South Halsted near 44th street.

NUMBERING PLAN.

It is probably unnecessary to explain at this day that the trunking between these various offices is done by means of automatic switches, without the aid of operators; and that a subscriber does not know whether the number he is calling

is connected to his own office or to a distant one. The trunking system is based on the usual scheme of having all numbers in each office commence with a figure which is used only in that office or its branches. For example, all numbers in the Chronicle building office commence with the figure "3" and run from 31,000 to 36,500. The North office is a subsidiary to the Chronicle office, and its numbers run from 37,000 to 38,500. Connector switches—third selectors and line switches—are installed at the North office, but no first selectors or second selectors (see Fig. 2); consequently, a party calling North office from the Brooks building, for example, operates a first selector switch in the Brooks building office which selects an idle trunk to the Chronicle office; he there operates a second selector switch which picks out an idle trunk to the North office. A third selector is there operated and extends the connection to a connector switch at

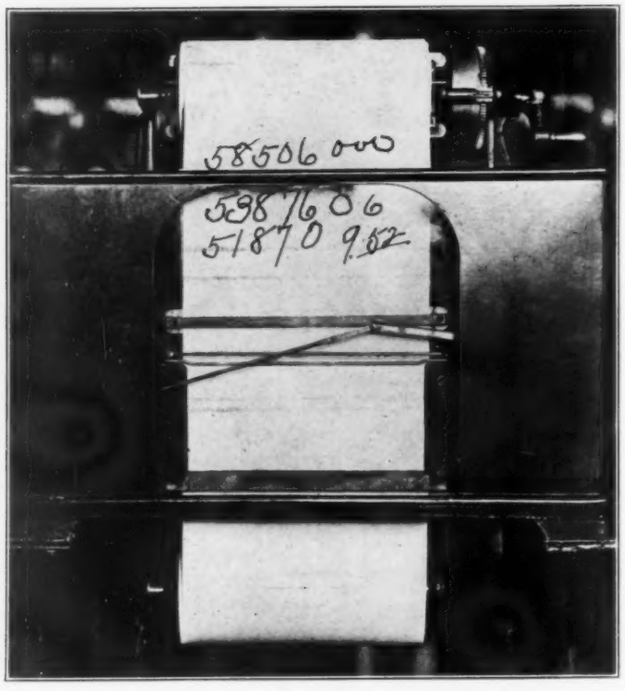


Fig. 3. Telautograph for Trouble Records.

North which completes the connection to the party desired.

The numbers in the Chemical building office all commence with "4"; those in the Brooks building commence with "5"; those in the Plymouth court office commence with "6"; those in West office commence with "8"; and those in Yards and Cottage Grove offices commence with "7."

The Yards office is a branch of Cottage Grove office, but is not a district station. It is a full branch with equipment installed in it for completing all local connections between parties in the Yards district. All calls going to the "South Side," however, from other parts of the city are carried over common trunks to the Cottage Grove office, and are there automatically distributed as required between the Cottage Grove and Yards offices. The numbers at Yard office are in 70,000, 78,000 and 79,000. The remaining 7,000 numbers for this section are used at the Cottage Grove office.

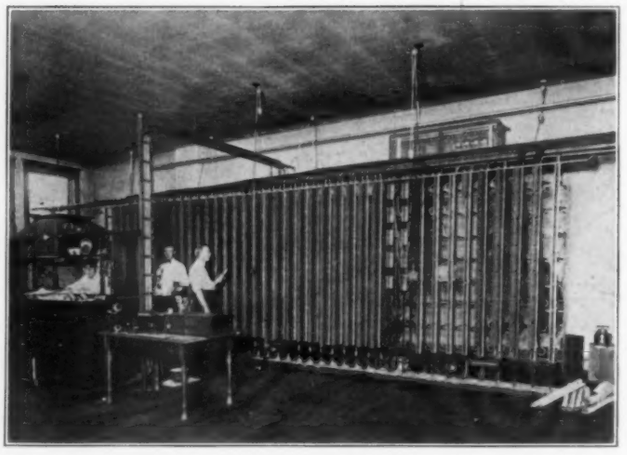


Fig. 4. Wire Chief's Desk.

Provision is made for handling calls to the long distance switchboards in the usual way, by having the words "Long Distance" printed on each dial number-disc back of the "0" finger hole, so that in the near future, when the long distance board is in operation, any subscriber will be able to secure a recording operator by turning his dial once from this finger hole. Information clerks are secured from all offices by calling the number 392, and the complaint clerks are secured from all offices by calling number 393.

SUPERVISORY FEATURES.

The information and complaint clerk's desk is installed at the Chronicle building headquarters, and all calls of these kinds are received there from the entire system. The board has four positions so designed that a call causes lamps to glow in all four positions and the first idle operator answers it. The first five information trunks are represented in the first position by white lights, in the second by red and in the third and fourth by green lights. Five other information trunks end in white lights in the third position, red lights in the fourth position and in green lights in the two other positions. The trouble trunks end in white lights in the second and fourth positions and in red and green lights in the other positions. Each operator answers white lights first, red lights next and then if idle answers green lights. In this way distribution

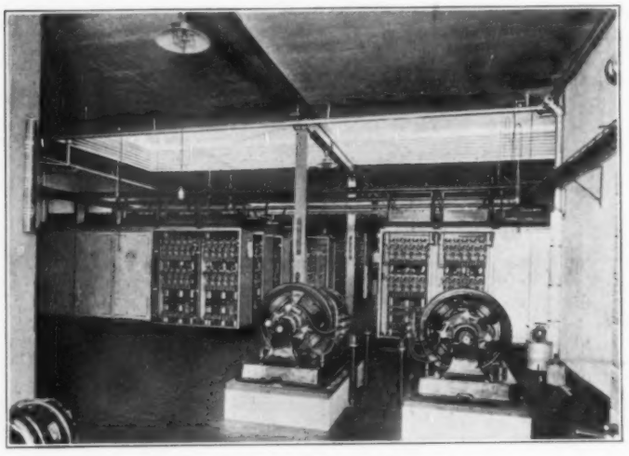


Fig. 5. Line Switches and Power Plant.

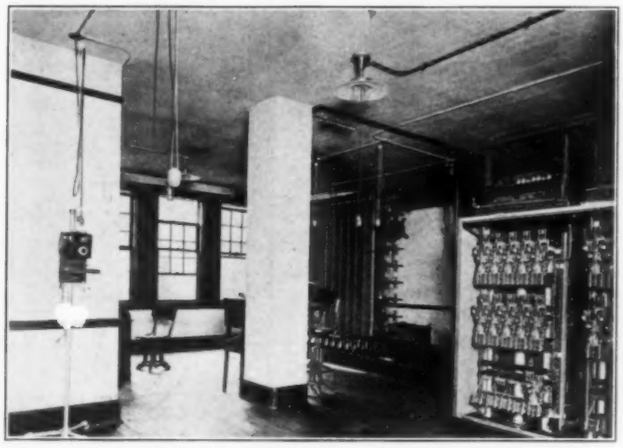


Fig. 6. Line Switches.

of the load is secured without eliminating co-operation. This arrangement gives a very rapid and satisfactory service. The board is now handling about 2,400 calls per day, most of which are inquiries for the numbers of new subscribers.

Subscribers' complaints are distributed from the complaint desk to the record clerks' desks, located at the various offices, in a novel way, by means of telautographs (see Fig. 3). These ingenious devices enable the complaint clerk to send by wire an autograph copy of each complaint to the record clerk, at the office in which the complaint should be investigated. This clerk acknowledges receipt of the complaint by a signal. With this system no complaints are lost—all are transmitted quickly and receive prompt attention.

A wire chief's desk (see Fig. 4) is installed at each of the offices, except the district station "North" and branch "Yards." At the latter two offices small testing outfits are installed, but arrangements are made so that lines at these offices may be tested also from their respective main offices. Following the practice adopted in most of the later automatic systems the wire chief does not test the lines by means of the old fashioned shoe or test-jack plugged in at the cross connecting frame, but by means of test connector switches, one of which is mounted on each line switch unit. By using these switches the wire chief

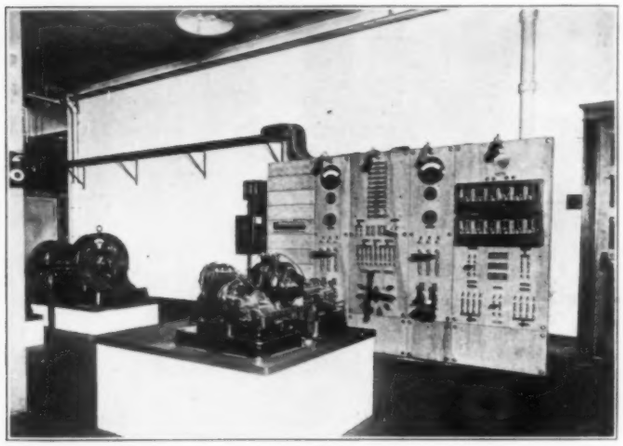


Fig. 8. One of the Power Boards.

can test any line, either in or out, without the aid of a rack man or other assistants. This makes the testing of the lines considerably more rapid and economical than by the old method and saves a great deal of wear and tear on the protectors of the cross connecting frame.

When the long distance board is installed these same special switches will be used by the long distance operators in setting up connections. The use of them will make it possible to supply more current on each long distance connection than is supplied on a local connection. They will also make it possible for a long distance operator to call an automatic telephone line and hold it awaiting the completion of a long distance connection without automatically ringing the local telephone bell.

CENTRAL OFFICE EQUIPMENT.

The remaining central office equipment comprises the automatic switchboards and power plants, which are of the standard type of the Automatic Electric Company; and very similar to those installed at San Francisco, Cal.; Spokane, Wash.; Calgary, Canada; Havana, Cuba, and in other late systems. Some details about this equipment may be interesting however.

Each office is equipped with apparatus for individual lines—four-party lines and private branch exchange trunks. Line-switch units of the usual type are employed (see Figs. 5 and 6), which carry 100 line-switches with two master switches on one side and

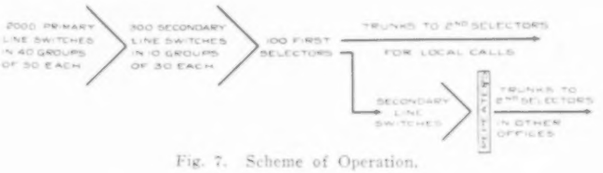

2000 PRIMARY LINE SWITCHES IN 40 GROUPS OF 50 EACH
300 SECONDARY LINE SWITCHES IN 10 GROUPS OF 30 EACH
100 FIRST SELECTORS
TRUNKS TO 2ND SELECTORS FOR LOCAL CALLS
SECONDARY LINE SWITCHES
TRUNKS TO 2ND SELECTORS IN OTHER OFFICES

Fig. 7. Scheme of Operation.

banks for fifteen connector switches, with ten regular connectors and one test connector mounted on the other side. The master switches on the line-switch side are not linked together, but each operates its group of fifty lines independently. Seven trunks are installed from one group of fifty line-switches and eight from the other to secondary line-switches. Primary line-switches are arranged in sections of 2,000 each—each section being served by 100 first selector switches. Consequently, as shown in Fig. 7, the 300 trunks from 2,000 primary line-switches pass through 300 secondary line-switches arranged in ten groups of thirty each; then through 100 trunks to 100 first selector switches. Local connections are then trunked through second and third selectors in the usual way. Connections outgoing from any office to other offices are trunked from first selector switches through another group of secondary line-switches for the purpose of making trunks between offices as efficient as possible. This practice is the same as that used in San Francisco. Each such trunk also passes through a repeater, so that a calling party receives talking current from the battery at his own office. Talking current is, of course, supplied to each called party from the connector switch employed at his office. The four-party line line-switch units carry twenty-one connector banks with twenty regular connectors mounted in four groups of five each, and one test connector. The rotary connection or private branch exchange line-switch units each carry twenty-one connector banks,

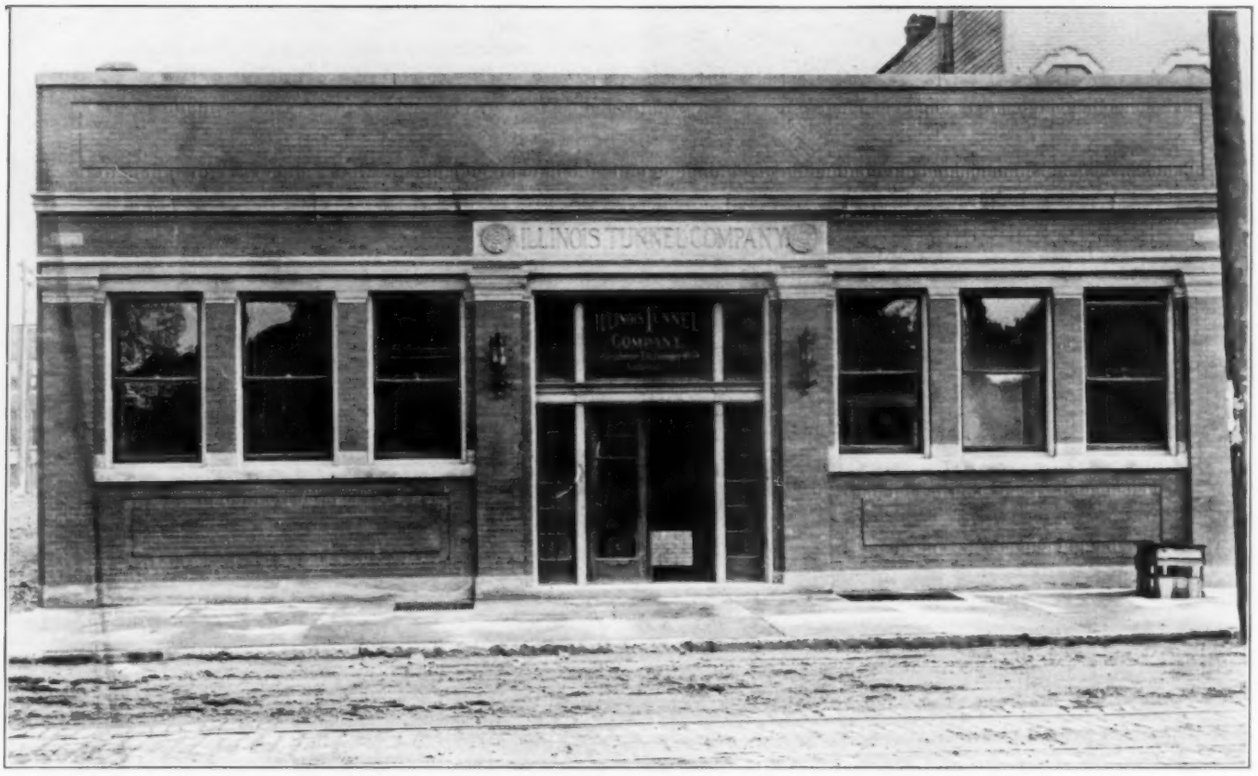


Fig. 16. West Office.

also with fifteen regular connectors and one test connector mounted. These switches make it possible to give a private branch exchange subscriber any number of trunks, all of which appear under one number in the directory, for by means of them a calling party is automatically switched to an idle trunk.

In the power plants of the various offices are found handsome pink Tennessee marble power switching panels, equipped with the full complement of knife switches, circuit breakers, ammeters, volt meters, etc. (Fig 8). Each office is served by one large storage battery (Fig. 9). In order to make it practical to charge the battery and to use it at the same time without materially raising the voltage on the busbars to the automatic switchboard, counter electro-motive-force cells are installed in each battery room. These are connected to a counter E. M. F. cell switch mounted on the power panel, so that the cells may be cut in and out one at a time on the leads from the battery to the switchboard. For further aid in keeping the voltage on the switchboards properly regulated a Weston voltage alarm relay is installed in connection with each switchboard, so that if the voltage drops below or rises above predetermined points an alarm bell will be immediately rung. Duplicate motor generators for charging and duplicate machines for ringing individual lines are furnished; also duplicate harmonic converter outfits for ringing on party lines are mounted on marble panels and are installed at each office as a part of the power switching board (See right hand panel Fig. 8).

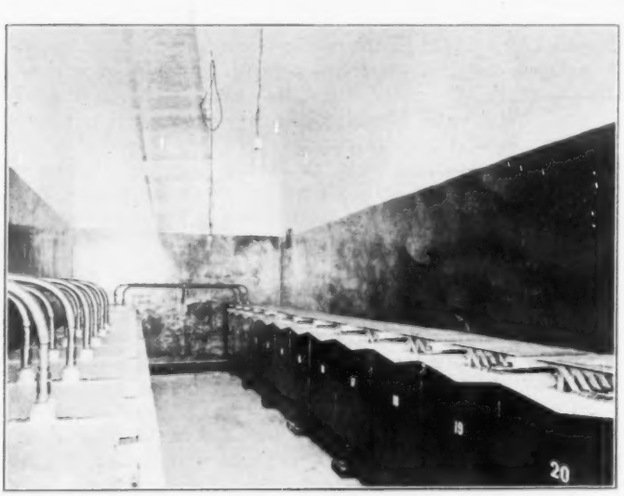


Fig. 9. Storage Battery Equipment.

SUBSCRIBERS' STATION EQUIPMENT.

The subscribers' instruments are of the latest type, equipped with two-wire calling device and direct current receivers (Figs. 10 and 11). Desk stands have black enameled bases and handle tubes. The wall telephone boxes are finished in ebony. No push buttons are, of course, provided since ringing is automatic. A party line telephone is the same as an individual line, except that the ordinary individual line ringer is displaced by a harmonic ringer.

Several thousand of the subscribers' telephones have been equipped with nickel-in-the-slot machines. A number of these coin collectors have been used with the wall telephones in one other city, but they are used with desk telephones for the first time in Chicago. Fig. 12 shows a collector mounted with a wall

telephone and Fig. 13 shows how one is assembled with a desk telephone, so that the combination may be set on a counter and lifted about by means of the handle. Each collector is so arranged that a party making a call does so the customary way and after he has finished turning his dial awaits with nickel in hand the answer of the called party. When the called party's voice is heard he drops the nickel in the slot, and as the coin passes to the coin box it trips a trigger which operates platinum pointed springs that connect the calling party's transmitter to the line, thus making it possible for the calling party then to speak to the called party. If the desired party is busy or does not respond, the coin is not deposited.

A very interesting feature in connection with these pay stations is an arrangement which enables a subscriber calling from one of them to speak to the information clerk, trouble clerk, to long distance, or to any of the Tunnel Company's officials without depositing a coin. This is handled automatically by a circuit arrangement which prevents the operation of the automatic transmitter cutoff in a coin collector when a "no-pay" line is called.

Private branch exchanges of three different types are in operation in connection with the Chicago system, namely:

First—Intercommunicating systems of the push button type.

Second—Systems using small manually operated switchboards, the same as those commonly used in connection with manual central office systems.

Third—Full automatic P. B. X. switchboards.

As has already been mentioned in connection with rotary connectors, spoken of in the description of the central office equipment, each of these private branch exchange systems of the first two types may have several incoming trunks and an incoming call is switched to an idle trunk by means of the rotary connector switches at the central office. An idle outgoing trunk is selected by the calling subscriber using a push button intercommunicating system. Each trunk is represented in each push button box by a key so that a subscriber wishing to make a call presses a key corresponding to one trunk, and if he then receives the busy signal, he tries another trunk.

Fig. 10. Standard Desk Set.

An idle outgoing trunk from a P. B. X. switch-

Fig. 18. Cottage Grove Office.

board employing an operator is, of course, selected by the operator in the usual way. She then proceeds to secure the party desired, by switching her calling device on the idle trunk and operating it in the usual way; or, if the P. B. X. subscriber has a telephone equipped with a calling device and desires to call the number himself, or to make a number of calls in succession, without bothering with the operator, she connects him through to a non-busy trunk and he calls whoever he wishes.

The P. B. X. trunks may be two-way, or separate trunks may be used for incoming and outgoing business as desired. These boards are so designed that each operator has double lamp supervision over all calls through her board. The equipment operates on 24 volts, using current furnished from the large storage battery at each central office. The battery supply leads are bridged with dry cells and condensers at each P. B. X.

A typical example of the third class of private branch exchange systems using full automatic switchboards is the one installed at the factory of the Automatic Electric Company. This was in operation for a number of years before the public system was put into service and was connected in with the public system about May 15. This private system consists

Fig. 11. Well Set.

of 100 telephones distributed throughout the factory on the various foremen's desks and through the various offices and laboratories. Employes and officials of the company call each other by using three figure numbers commencing with the digit "1." The local switchboard therefore employs nine switches, first selector switches and connector switches only.

To the second level of first selector banks are connected three trunks outgoing to the public switchboard in the Brooks building office and there terminating in line switches the same as other subscribers' lines, so that by prefixing the figure "2" to any number shown in the public exchange directory, an official of the Automatic Electric Company can call any subscriber of the public system through the same telephone that he uses for local service. This privilege is also extended to those employes of the company who have occasion to make outside calls; but it is so arranged that foremen and others, who do not have such occasion, are automatically prevented from calling outside of the factory.

Three incoming trunks terminate in three connector switches on the private switchboard in the factory and in fourth selector banks in the Brooks building. A small group of these fourth selector banks and switches is installed in each of the loop offices for the express purpose of calling automatic P. B. X.'s. With

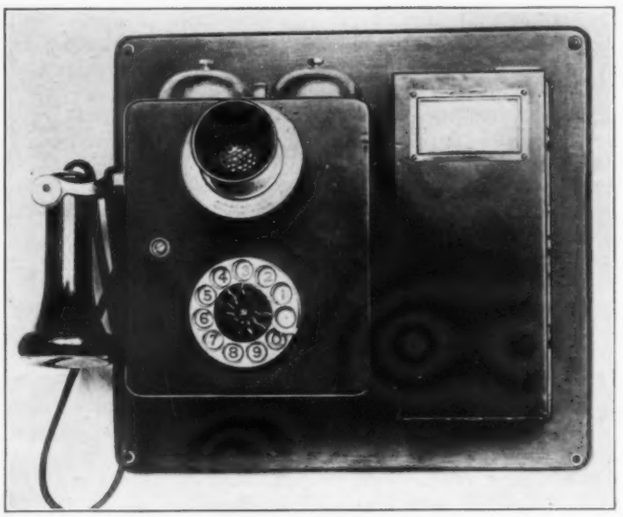


Fig. 12. Wall Pay Station.

this arrangement any public exchange subscriber calling 5891 is given an idle trunk to the factory, and there the connector switch in which the trunk terminates completes the connection to the desired official or employe. Incoming calls from the outside are also restricted automatically to those who are required to receive them.

It is interesting to know in this connection that subscribers to such an automatic P. B. X. may call each other, not only direct through the local switchboard, but also through the public switchboard. The latter feat is accomplished by prefixing "2" to one of the local numbers, as it appears in the public exchange directory. For example: The local number of H. D. Critchfield, the Automatic Electric Company's sales manager, is 162—his number appears in the public directory 5891-62. Another official of the company can call Mr. Critchfield through the public exchange by calling the seven figure number (2-5891-62). An automatic system using numbers of this size would

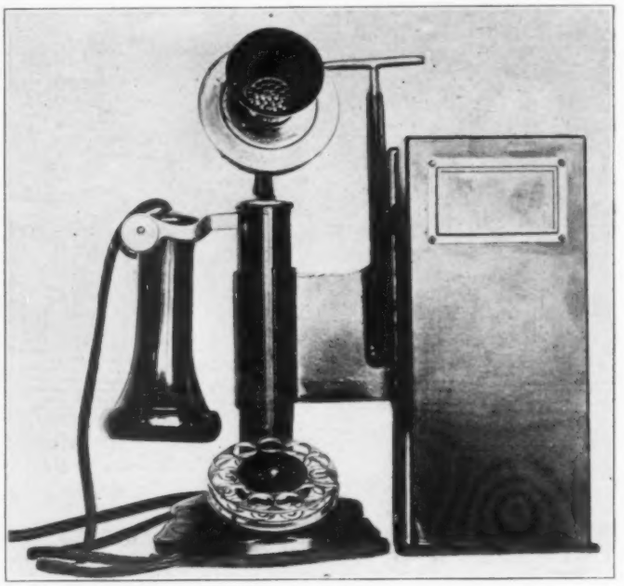


Fig. 13. Desk Pay Station.

have an ultimate capacity of 10,000,000 lines. To call such a number and complete the connection to the desired party requires approximately seven seconds of time, which is considerably speedier than good, average service in manual practice.

Arrangements are being made to try out in Chicago a new extension telephone circuit recently devised by T. G. Martin, which it appears should become quite popular. The circuit devised by Mr. Martin makes it possible to connect two telephones on the same line. (For example, one on an office boy's desk and another on his employer's desk) in such a way that each incoming call may be answered by the office boy. He can then throw a locking key which will enable him to "buzz" and talk to his employer, with talking current supplied over the line from the main office, but without the calling party overhearing the conversation. The restoration of this locking key to normal position then enables him or his employer to talk with the calling party.

SERVICE.

The Chicago telephone public has been very favorably impressed with the service given by the new company. It was, of course, expected that patrons would be pleased with the elimination of the operator and with the speed of the service given by the new system, but the Tunnel Company's officials have been considerably surprised by the large number of compliments they have received on the excellence of the transmission through the new system. The amount of calling through the various offices is rapidly increasing and becoming quite heavy, as the list of subscribers grows and the public learn more and more to use the new telephone. The service is especially popular among the brokers on La Salle street, where quick connections and lots of them in rapid succession are desired during stock exchange hours. A supervisor in the Brooks building office, who happened to be watching calls made by one of these brokers a few days ago, timed a few of his connections with a stop watch, and found that in sixty-five seconds by the watch, the broker called four different parties in succession, talked to each and disconnected.

UNDERGROUND CONSTRUCTION.

The line and trunk cables of the loop district are hung underneath the roof of the Tunnel Company's freight tunnels, of which there are sixty miles underneath Chicago's streets. Entrance to buildings in the district reached by the tunnels are made direct through laterals from the tunnels to entrance boxes in the basements. A typical entrance to a subscribers' building is shown in Fig. 14 and to a central office building in Fig. 15. Outside of the tunnel district cables are carried through underground conduits in the usual manner, the distribution being made both by means of laterals to the basements and by means of can-top poles in the alleys. There is not one cross arm used throughout the entire plant. Drop wires are of copper-clad steel, rubber covered and braided, twisted pair. Special brackets with special double grooved porcelain knobs are used for aerial distribution. Cables are suspended by marlin hangers. Line cables are of No. 22 gauge .08 mutual capacity and trunk cables of No. 19 gauge .08 regular capacity. First class material is used throughout in the construction and all is installed in accordance with the most approved practice.

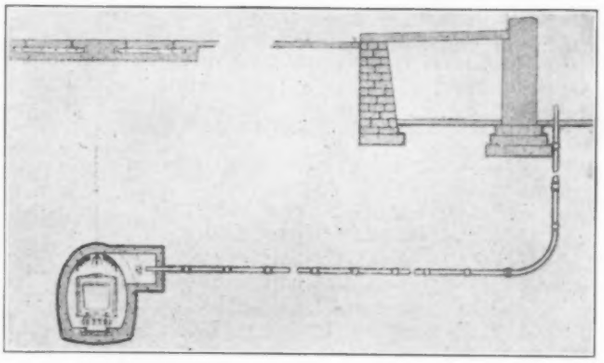


Fig. 14. Typical Entrance to Subscriber's Premises.

The exchanges in the loop district are installed in buildings which had been previously erected, but three of the offices outside of the loop have been installed in new buildings built especially to house the equipment. Pictures of these three buildings are shown (Figs. 16, 17 and 18).

Construction is being commenced on the addition to the second story of the West office building to provide room for housing the long distance equipment, which is now being built by the Automatic Electric Company and on which installation will be commenced in the very near future, as soon as the building is ready for it. All the buildings are substantial and have space for growth of the switchboards; in fact, it is evident throughout the entire system that the Tunnel Company has made its plans with a view to permanency and a large growth.

SPEED OF INSTALLATION.

All of the central office equipment was planned, manufactured, delivered and installed by the Automatic Electric Company in twelve months time, under the direction of the company's chief construction engineer, T. E. Meyer, and its chief installer, E. R. Neir. Mr. Neir meanwhile acted also as first assistant to B. C. Groh, chief engineer of the Subway Telephone Construction Company, which executed the contract for the entire system. It therefore may be imagined that Mr. Neir has been one of the busiest men in Chicago during the past year.

The amount of work done by the construction

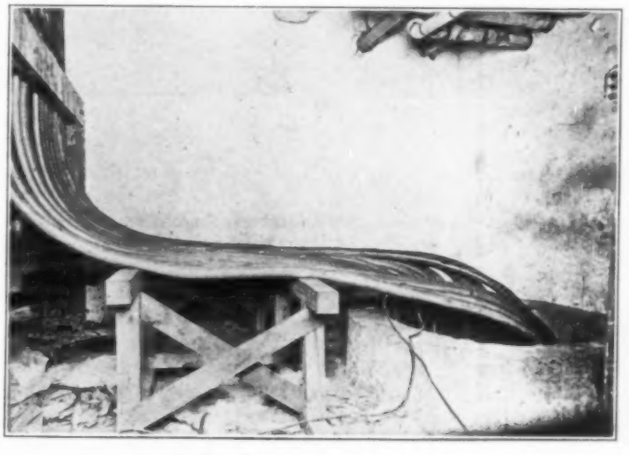


Fig. 15. Entrance to Office Building.

company in one year's time, under the management of F. E. Ebersole, assistant to the president, and B. C. Groh, engineer, is also probably unparalleled in telephone history. In this space of time the following was installed, connected up, tested out and put into service:

821,000 duct feet of conduit.
165,000 feet of 25 pair cable.
320,000 feet of 50 pair cable.
102,000 feet of 100 pair cable.
71,000 feet of 200 pair cable.
190,000 feet of 400 pair cable.
60,000 feet of 600 pair cable.
110,000 feet No. 19 gauge 200 pair trunk cable.
500,000 feet of suspension strand.
1,500,000 feet of drop wire.
2,270,000 feet of interior wire.

While the work was done rapidly, it was at the same time carefully engineered and done well. For example, the development study was sufficiently accurate and the cable distribution was planned so well in the Cottage Grove district, that when the solicitors

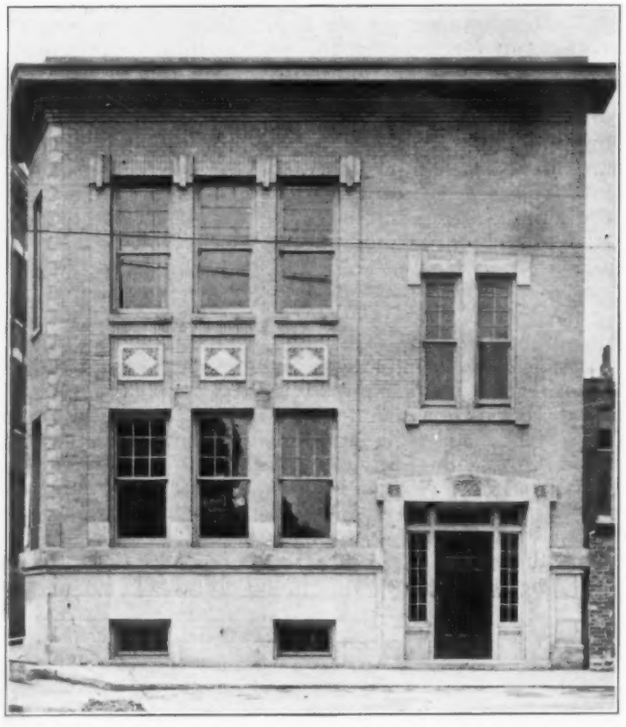


Fig. 17. North Office.

and subscribers' station installers had done their work it was found that an efficiency of 81 per cent of the cable plant had been secured without any measures for relief or deviations of any kind from the engineer's original plans having been made. This has probably not been equaled in systems installed where time was not so important a factor.

Great credit is due, not only to the men in charge, but to the many employes who were brought together for the first time in the construction company's new and speedily formed organization; and who, by their team work and faithfulness, enabled the construction company to complete its enormous contract on time.

Postal to Enter Telephone Field

Experiments having demonstrated that it is possible to send telephone and telegraph messages by the same wires at the same time, the Postal Telegraph Company has decided to operate a telephone service in some of the cities of the far West. This announcement was made June 13 at the offices of the company. While it has long been known that telegraph wires might be used for telephone purposes there has been no attempt to develop a telephone system along this line.

The experiments were conducted between Salt Lake City, Utah, and Reno, Nev., and between the latter place and San Francisco, Cal., and so successful were they that the company at once began perfecting plans to put the system to practical use. Voices in telephonic communication were distinguishable between Salt Lake City and Reno, a distance of four hundred miles, over telegraph wires which were laden with telegraph messages at the time.

Two new telegraph wires, thicker and heavier than the ordinary type, recently erected between Salt Lake City and San Francisco at a cost of $2,000,000, were used in making the experiments. The heavier wire is necessary to get the best results for the combination of telegraph and telephone service. The wire weighs 435 pounds to the mile as against 210 and 300 pounds, the standard weights now in use. One of the officials of the company said that from now on the company planned to use the heavier wire entirely in making extensions and replacing old wires, in order that it may be ready at any future time to use the wires for both purposes. These heavy wires will be installed in the East as well as in the West.

Through telephone service by Postal wires between Salt Lake City and San Francisco, a distance of eight hundred miles, will be possible by the erection of a new power plant at Reno. It is altogether likely that Salt Lake City will be the first to get the benefit of the company's local telephone service. Telephonic communication by the telegraph wires between headquarters in New York and Albany, Philadelphia and near by places for company business only was established some time ago.

Long Distance Hypnotism

Hypnotism by long distance telephone and telegraph was apparently accomplished at Canton, Ohio, before a crowd of several hundred people and a committee of doctors. The hypnotist was an amateur, Fernando Q. Loutzenheiser, a telegraph operator, and the test was the result of a wager.

Loutzenheiser, from the Fort Pitt Hotel, in Pittsburg, commanded five Canton young men to do a number of things and finally put them in a state which the doctors declared was a sound sleep, in the lobby of the Courtland hotel. One of them was made so rigid that Dr. L. A. Buchman stood on his body as it rested on the tips of two chairs.

After three of the subjects were put to sleep they were placed on exhibition in show windows of Canton stores, to remain there a day.

As a crowning feature Loutzenheiser sent a telegram to the last named two telling them to go to sleep for a minute, and, to all appearances, no sooner had they read the message than they became unconscious. The doctors explained the phenomena by the operation of a strong will upon weaker wills.

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

WHEN W. Lee Campbell came to Chicago in the spring of 1895, he straightaway hunted up L. W. Noyes and asked him for a job. There were two reasons for this—(a) Campbell wanted a job, and (b) L. A. Noyes was the man most likely to give him one.

Mr. Noyes, it may be remarked, was one of the very few men that the drouth and panic of the preceding year had not affected. He was engaged in the manufacture of aermotors, and if you had traveled westward about then, you would have discovered that nearly every farmer had an aermotor or was going to get one right away. Whether Mr. Noyes had a prospective customers' list or not, the sons of Iowa farmers were always welcome at his big factory. Mr. Noyes had left Ames a few years before and had made a "killing" in Chicago. Campbell knew this and he also knew that what Noyes had done, he could also do. So the timekeeper took his name and he lasted for several paydays—six to be exact.

He Was Never Intended for a Clerkship.

This is significant only in its application to Campbell's coming to Chicago and that he was never intended for a clerkship—which is proven.

Let us see about W. Lee Campbell before he came to Chicago. The start was on a farm in the northeastern corner of Muscatine county, Iowa, where he was born August 9, 1874. That would make him a pioneer without any choice in the matter, for Iowa was pretty raw in 1874. Campbell's early education was fraught with the usual hardships of a farmer's son, but he struggled through with it until he was twelve, under the handicap of his red hair and the usual appellation of "Red." When he went to Newton, conditions were improved, but his hair didn't change color—hasn't yet for that matter, although it shows thin in spots. But at Newton, Campbell got his high school and that was what he wanted. He graduated from Newton High School in 1890 and entered Iowa State College at Ames the same year where he had four years of technical training, graduating in 1894 with the degrees of C. E. and M. E. Thus equipped, he taught school for one year, before coming to Chicago and trying a clerkship. Say what you may, a college course destroys ability or availability for clerks!

Whether the law of natural selection or something akin to it had any bearing on the case, Campbell welcomed the opportunity to join the Strowger Automatic Telephone Exchange, then struggling with an apparatus that required further electrical and mechanical development.

Constituting the Strowger force at that time were Joseph Harris, Alexander Elsworth Keith, Talbot G. Martin and John and Charley Erickson. Campbell was fresh, original and full of faith and energy. He fitted in, for he and the men who have just been named are all on the same job today. Nothing better could be offered to prove Campbell's efficiency and stick-to-itiveness. He wanted electrical and factory experience when he took hold and he has never wanted for either since. His superiors have always understood and appreciated their "find."

After ten weeks in the factory, Campbell was sent to Michigan City to assist in installing the first system of automatic telephones employing the present type of banks. It was also the first system equipped for more than a hundred lines.

At the completion of this work, Mr. Campbell remained in Michigan City for nearly two years, extending and managing the plant until his subscribers outnumbered those of the Central Union. So successful was he in this work that his company sent him to Georgia, where for two years he was superintendent and four years manager of the Augusta Telephone & Electric Company. The Augusta plant was the first automatic employing over a thousand lines. It was in this good old southern city where W. Lee Campbell married.

In February, 1903, at the request of the reorganized Automatic Electric Company, he came back to Chicago. His work was in the assembling and testing department, occupying the position of expert and foreman. In the fall of the same year he was made assistant to Mr. Keith, chief engineer and general superintendent. In this capacity he continued right along until 1908, when Mr. Keith dropped his title of general

superintendent and Campbell promptly picked it up.

Wilson Lee Campbell is still the general superintendent of the Automatic Electric Company, responsible for the output and product of a thousand men. He lives in La Grange—essentially a home man. He has no clubs for the very good reason that he has no time for them. His recreation—the little time he gives it—is tennis. Campbell listens well and talks well and holds himself well in reserve. He is moderate in his ambition; kindly; equable and content—a steady friend.

New York Commission News

The New York Public Service Commission, second district, has authorized the Federal Telephone and Telegraph Company to issue $578,000 of five percent bonds upon the security of its mortgage dated March 24, 1909. Bonds to the amount of $364,800 par value may be issued from time to time for the purchase of the entire outstanding issue of bonds of the Niagara Home Telephone Company amounting to $456,000 upon the express condition that for each and every bond of the Niagara Home Telephone Company so purchased and acquired there will be issued therefor bonds of the Federal Telephone and Telegraph Company to the amount of 80 per cent only of the par value of the Niagara Home Telephone Company bonds, and upon the further condition that there shall be acquired presently from the Niagara company bonds to the amount of $275,000 par value. Bonds to the amount of $64,000 are allowed to be issued for the acquisition and purchase of the entire issued and outstanding capital stock of the Dunkirk Home Telephone Company, the exchange of bonds for stock to be par for par on the condition that there shall be acquired presently of this stock shares to the amount par value of $39,000. A total of $150,000 of bonds are to be issued for the purchase and acquisition of the property of the Independent Union Telephone Company, a long distance line west of the city of Syracuse, including all property and rights of this company in the state of Pennsylvania. This latter purchase is authorized upon the express condition that at the time of the purchase and organization of the properties of the Independent Union Telephone Company and the issue of bonds therefor, the Independent Union property shall be free and clear of all liens and incumbrances, etc., and that an absolute and unqualified title in fee be given to the Federal company.

The commission has approved of the sale, transfer and assignment to the Federal Telephone and Telegraph Company of the franchise held by the Warner Telephone Company, Penn Yan Telephone Company, Wayland Independent Telephone Company, Clifton Springs Telephone Company, Livingston County Telephone Company, Salamanca Telephone and Telegraph Company, which companies operate in the villages of Gowanda, Lima, Dansville, Livonia, Geneseo, Honeoye Falls, Penn Yan and Wayland.

A reduction of telephone rates from the Borough of Manhattan below 110th street to the Borough of Brooklyn, except Coney Island and Bath Beach, and from Manhattan below 110th street to Central station districts Astoria and Newton on Long Island, from ten cents to five cents, and reductions from fifteen cents to ten cents from Manhattan below 110th street to Central station districts Flushing, Richmond Hill, and Jamaica on Long Island, is ordered by the New York Public Service Commission, second district, as a result of an inquiry conducted by the Commission on its own motion as to whether certain toll rates charged by the New York Telephone Company in the city of New York are in whole or in part just and reasonable, or unjustly discriminatory or unduly preferential, or in anywise in violation of law.

Powers of New Jersey Commission

The new public utilities law of New Jersey which went into effect May 1 makes important changes in the policy of that state regarding public service corporations. It gives the commission the power to make rates and appraisals.

The present board is to constitute the commission until the expiration of the term of office of each commissioner, when a successor shall be appointed for six years in each case. The commissioner must be at least thirty years of age and may be removed by the governor for neglect of duty or misconduct. The salary is $7,500 per year instead of $6,000, as under the old law. No commissioner or employe shall have any connection with or hold any securities in any public utility operating within the state, or hold any other position of profit or trust under the government of the state or of the United States. The total expenses including salaries are limited to $100,000, while under the old law the annual expenditure was limited to $50,000.

The board shall have general supervision and regulation of all public utilities, which are defined to include substantially every plant or equipment for public use under privileges granted by the state or any political division thereof. The board has power to investigate, upon its own initiative or upon complaint in writing, any matter concerning any public utility, also to appraise from time to time the property of any public utility whenever in the judgment of the board it shall be necessary to carry out any of the provisions of the act. The board shall also have power to fix just and reasonable rates when it shall determine existing rates are unjust, unreasonable, insufficient, or unjustly discriminatory or preferential. Power is given the board to fix just and reasonable standards and measurements. The board shall have power to fix adequate and serviceable standards for the measurement of quantity, quality or other conditions pertaining to the product or service rendered, and to prescribe reasonable regulations for the examinations and tests of product in service. It also has the power to establish reasonable rules and standards to secure the accuracy of meters and appliances for measurements and to provide for their examination and test.

The Wisconsin Railroad Commission, acting upon a petition presented by the National Travelers' Association, in which it claimed that in charging five cents for outgoing telephone calls from hotel rooms in Milwaukee, the Wisconsin Telephone Company violated its published tariffs, the commission decided in favor of the petitioners. Under this ruling such charges cannot be made and the telephone company has been ordered to cancel all contracts entered into with hotelkeepers previous to April 1, 1907, which contain the ten-cent outgoing charge.

The commission has granted the Argyle Telephone Company, Argyle, Wis., permission to increase its rural rates from $3 to $6.

The Telephone Scrap Book

"Wait a Minute"

OF course you telephone, says Mike McKinney, teamster and editor of *The Gimlet*. I telephone. Everybody telephones. Suppose you ring up any large hardware house, or any small hardware house where they have clerks, and ask a question. I will bet you a big red apple that the answer will be, "wait a minute."

Today I telephoned to a great commercial house simply asking information as to what factory makes a certain item. First I called the house. I told the central telephone girl what I wanted. She answered, "wait a minute." I waited. After a while some office boy, judging by the voice, asked what I wanted. I explained carefully. He answered, "wait a minute." Next a short, sharp voice inquired, "what is it?" From the tone of the voice I judged the man to be nervous. Perhaps he is overworking himself—of nights. Again I explained clearly what I wanted. He answered, "wait a minute." After quite a long wait another voice asked just what I wanted. Again I explained in detail. This was a quiet voice. The man asked a few questions, and then carefully and deliberately gave me the names and addresses of several manufacturers. I do not know who this last man was, I may never meet him, but from his calm and steady voice and the accurate information he gave me I am sure he is a valuable man in the institution. He did not say, "wait a minute." He adjusted his mind to what I wanted by asking a few questions, and then evidently from memory, without reference to any records, he gave me just the information I desired.

Then there are some presidents of banks, and others of less importance in the commercial stellar system, who have a habit that is hardly fair. It is a telephone habit. They have their stenographer ring you up and then when you answer, the stenographer says, "wait a minute." So you sit and wait and consume your time, until the other fellow—who wants ou—gets ready to answer the telephone. It is to be presumed that he is telephoning you about his business. Generally he desires to ask a favor of some kind. It does seem to me, just a common teaser, that when people telephone about their business and ask a favor of or help from some one else, they should at least ring up this person themselves, and not put the other fellow in the position of "waiting a minute" on them.

Of course when your banker telephones you in this way you make allowances. All of us are charitable towards our bankers. There are times when we need the money. But when a manufacturer's broker, a life insurance agent, or some other lesser light tries the same game it does not make a selling hit with us.

Of one thing I am sure and that is, no salesman should every try to sell goods in this manner. The best salesmanship is direct personal contact. When you try to sell a man goods by telephone don't let him "wait a minute" while you are getting ready. A salesman should save the other fellow's time as well as his own.

The other day I had occasion to telephone to the president of a large house. First the central telephone girl answered. Next the president answered. There was no "wait a minute." Immediately afterwards I telephoned to the manager of a certain department in the same house. First central answered. Then some other young and charming lady answered and said, "wait a minute." I waited. No answer came. Then I found I had been cut off. So I tried it again. Once more central answered, and again the lady with the sweet voice said, "wait a minute." After a while a young man's voice said, "is your business very important?" When I assured him it was, he answered, "wait a minute." After a while this very important heavy-weight manager of a department got to the telephone. It was easy to get the president, but it was hard work to get the head of a department. The president was promptly on the wire, but the head of the department was two girls and one young man removed.

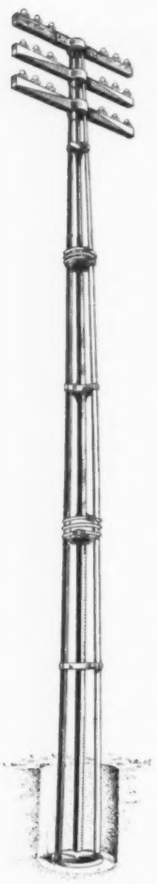
Now just a useful suggestion to presidents of corporations. Some day when you have a spare hour at the country club, sit at the telephone and ring up the various departments in your office and listen to the kind of answers you get. You will find, my dear sir, that some of your heads of departments are a great deal bigger men than you are yourself, they are more inaccessible, they are harder to get to.

And allow me to say that you will become rather weary of the same old phrase, "wait a minute." I think if I were the head of a great house I would cut out that expression and substitute in its place "just a moment." Wouldn't that sound better? This is along the thought of suggestion. When a man has already been waiting it is not a pleasant suggestion to him to be told to wait some more. Then "just a moment" seems shorter. Suppose all of us in the hardware trade adopt this phrase.

While I am wandering around in this weak-minded way on the subject of telephoning, let me suggest that the central girl and all employes who tend to telephones, be instructed, in answering, to immediately give the name of the house. When they do this you know you have the right connection and you can proceed to talk business. But suppose you telephone to a certain house and an answer comes back like this, "Hello." Then you say, "Is this Smith-Brown & Co.?" and the answer is, "Yes, that's right." Then you go on to tell your story. Don't you see valuable time has been lost both by you and by the employe of the house?

Tests of Steel Poles

SECTIONAL steel poles are being manufactured by a company in Minneapolis and are offered as an efficient and economical substitute for wood poles in places where great strength and resiliency are required, as in supporting long spans at river crossings, etc. Results of tests recently conducted by an engineer on these poles are reported in *Public Service*.



Sectional Steel Pole.

The pole was composed of a top section consisting of 4 angles 2 by 2 by ¼-25 feet 5 inches and a bottom section of 4 angles 2½ by 2½ by ¼-20 feet 5 inches. The upper and lower portions were joined by a special splice composed of a cast iron thimble with vertical notches to receive the upper and lower angles side by side. The edges of all these angle notches were fitted with a series of horizontal notches to correspond to similar notches in the angles. In this case 4 sets of notches were used and after the angles were placed in position ⅝-inch rods were drawn into these notches by means of turn buckles, thus forming a series of hoops. The rods held the angles in place both by friction and shear of the rods between the castings and the angles.

At intervals of 5 feet the angles were further stayed by cast steel braces which were clamped on to the angles.

The angles were sloped ¼ inch per foot taken in the plane of the angles and the center line of the pole making the base 21½ inches between the angles.

The upper two feet of the pole were formed by bending the angles till they were paralled and putting in sufficient bolts to prevent the angles slipping.

It was estimated that the pole should sustain a horizontal pull perpendicular to the plane of the upper angles of about 800 pounds. The experimenter applied a load of 532 pounds with a deflection of 7 inches and could have applied a greater load, but did not, as he wanted to apply the load diagonally to this position.

For the diagonal position was estimated a load of 564 pounds and applied a load of 823 pounds and had a deflection of 18½ inches.

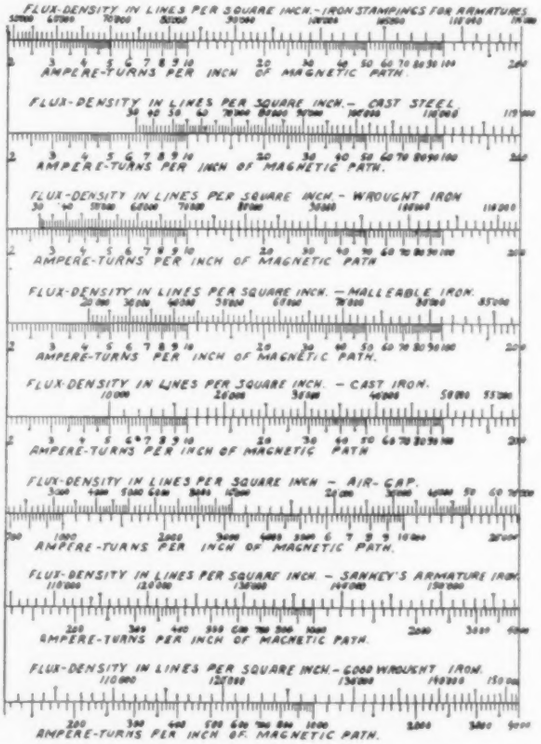
When the first and second loads were removed the pole resumed its normal position, showing no permanent set or distortion in the metal. While the first load was on a load of 180 pounds on the end of a 3-foot arm which was attached to the top of the pole gave it a torsional movement of about 45 degrees, but there was no evidence of a permanent distortion of the pole.

The weight of this pole was 850 pounds and it was 40 feet above the ground and carried a load of over 500 pounds with 7 inches deflection.

Will the day ever come when all poles are made of steel?

Magnetic Calculations

A VERY clear explanation of the calculations of magnetic circuits is found in Silvanus P. Thompson's book, "Design of Dynamos," published in London in 1903, says M. J. Eichhorn in the *Electrical Review and Western Electrician*. Thompson gives on Plate 1 in this work the usual curves of magnetic data for calculating windings drawn in a system of uniform rectangular co-ordinates, the ordinates of which represent flux-density in maxwells per square inch and the abscissæ ampere-turns per inch of magnetic path. I have constructed the nomogram shown here, which gives the same data in the form of a set of scales, graduated so as to give all the information about one particular kind of material on one line. By this method, which is called the method of numbered points and is due to Maurice D'Ocaghe, the results so


FLUX-DENSITY IN LINES PER SQUARE INCH.-IRON STAMPINGS FOR ARMATURES.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.
FLUX-DENSITY IN LINES PER SQUARE INCH.- CAST STEEL.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.
FLUX-DENSITY IN LINES PER SQUARE INCH.- WROUGHT IRON.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.
FLUX-DENSITY IN LINES PER SQUARE INCH. - MALLEABLE IRON.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.
FLUX-DENSITY IN LINES PER SQUARE INCH. - CAST IRON.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.
FLUX-DENSITY IN LINES PER SQUARE INCH - AIR-GAP.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.
FLUX-DENSITY IN LINES PER SQUARE INCH. - SANKEY'S ARMATURE IRON.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.
FLUX-DENSITY IN LINES PER SQUARE INCH.- GOOD WROUGHT IRON.
AMPERE-TURNS PER INCH OF MAGNETIC PATH.

Monograms of Magnetic Calculations for Calculating Windings.

tabulated can be read off more quickly and without the liability of errors that is inherent in following a co-ordinate to the margin of the diagram. This method also permits a far closer and more accurate interpolation of the intermediate values than the Cartesian diagram. On examining the diagram closely it will be found that the bottom scale of the five upper scales is identical and numbered from 2 to 200, representing the ampere-turns per inch of magnetic path. This scale is a logarithmic scale, and on this as a basis is plotted the flux-densities in lines per square inch for the various materials as given by Thompson. Wherever a point is taken on any of the scales shown, it gives by reading on the two juxtaposed scales a pair of values of these two quantities or variables, which belong together, so that if one is given the other can be found immediately. The bottom scale on which the data are plotted can of course be

of any nature, and the reason why a logarithmic scale is used in this case in preference to a regular scale is that it is more condensed in the region of the higher values, where the flux-density changes more slowly. The three last lines show the relations of the quantities for the air-gap and for two kinds of iron carrying higher flux-densities.

The following example will illustrate the use of the nomogram. Supposing it is desired to find the number of ampere-turns of excitation necessary to drive a flux of 15,050,000 maxwells through a cast-iron yoke of a dynamo, and that the cross-section of this yoke is 350 square inches and its length 18 inches. The flux-density, usually denoted by the letter B, is $15,050,000/350 = 43,000$ maxwells per square inch. Looking for this value of the flux-density on the scale for cast iron, we find opposite this value the value 67 ampere-turns per inch of magnetic path, and as the latter is given as 18 inches, the total excitation required is $18 \times 67 = 1,206$ ampere-turns.

Models Used in Court Proceedings

PROCEEDINGS before the British Railway and Canal Commission instituted by the National Telephone Company of England were illustrated with models. These models were designed with the object of making as clear as possible to the court any engineering points which might arise.

There were fourteen of these models altogether, all but one of which were constructed at the telephone company's offices. The largest and most pretentious of them constituted a miniature town layout, with several exchanges connected together by various types of line construction. Another model showed overhead construction, churches and factories being introduced to illustrate some of the obstacles in line construction practice.

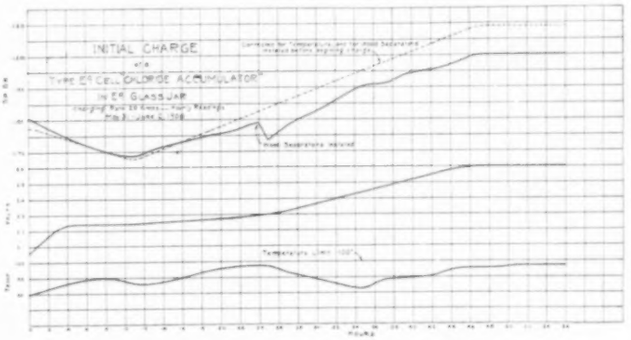
A third represented a full telephone exchange in miniature, with switchboard frames and desks. The illustration here is from a photograph of this model. The cross connections on the frames are made with threads of various colors to represent different services, and show clearly the method of grouping wires in a terminal room.

Others of the models showed pole lines, drop wire arrangements, manholes, conduits, cables, small magnets, switchboards, etc. *The National Telephone Journal* published the descriptions and illustrations of the models.

Installing a Storage Battery

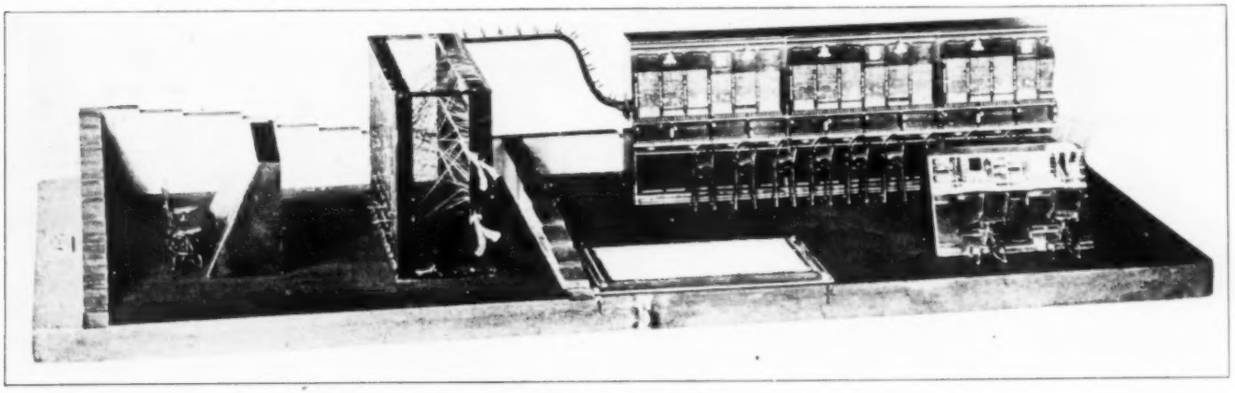
WHEN installing a new storage battery in the exchange, it is of the utmost importance that the initial charge be given properly. "The Chloride Accumulator in Telephone Service," a booklet issued by the Electric Storage Battery Company, gives the following directions:

After completing the installation and adding the electrolyte, the battery must receive an initial or first charge before it can be put into regular service. As



Curve Showing Initial Charge of Storage Battery.

charging in the wrong direction will seriously injure the battery, it is very necessary to have the positive pole of the charging source connected to the positive end of the battery, and this can be easily accomplished with the aid of a suitable Voltmeter. The positive plates have a brown color and the negative plates a light gray color, the colors becoming more distinct as the charge progresses. The duration of this charge is approximately forty-five to fifty-five hourse at the normal charging rate or the equivalent in ampere-hours. The charge should be continuous until, with all plates gassing freely, the gravity and voltage show no rise over a period of ten hours. If, however, the temperature reaches 100 degrees F., the charging rate must be reduced or the charge temporarily stopped. The figure shows curves made from readings obtained on an E-9 or 160-ampere-hour cell, the heavy black lines being observed readings taken every hour. The gravity curve shows a drop due to the wood separators being installed in the middle of the charge instead of at the beginning, as is now the practice. The dotted line indicates what would have been obtained if the



A Telephone Exchange in Miniature.

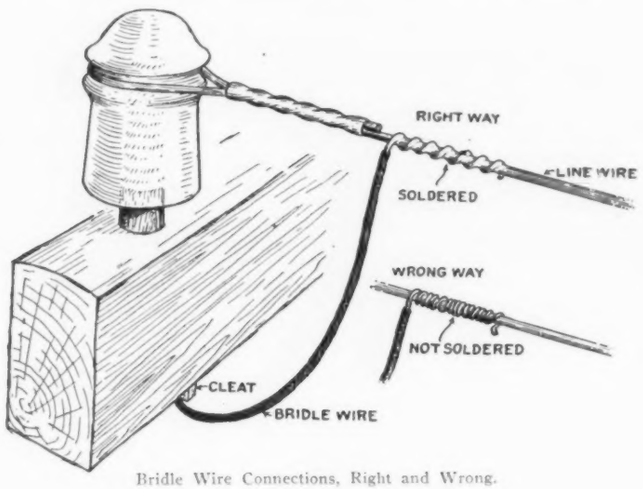
wood separators were installed at the beginning and the readings corrected for temperature. You will note that to have the gravity and voltage constant for ten hours it was necessary to charge a total of 56 hours, also that in this case the temperature approached the danger point during the day, but dropped off during the night. It is important to remember that if the charging rate is less than normal, the time required during which maximum readings are to be obtained, and, therefore, to complete the charge, is correspondingly increased.

Where it is impracticable to give the long initial charge, special arrangements can be made to have the negative plates charged before shipment. This involves their being forwarded in a wet condition, and the greatest care must be taken to keep them so until they are installed in the battery and covered with electrolyte. If there is any delay in their installation after being received, the plates should be taken out of the packing case and immediately immersed in pure water. If the negative plates are not allowed to dry out, the initial charge will be completed in from eight to twelve hours.

Splices and Bridle Wire Joints

LITTLE things are what count in line work, says the *W. & M. Telephone Wire News.* For example, a line should never have a splice close to a single pin transposition.

A splice in a wire has the effect of making it swing at a different rate from its mate. This difference is too slight to have much effect where the wires are parallel, but when they approach each other at the transposition it may be enough to make them touch, and if they do there is a good possibility of the splice catching and holding the other wire. If a conductor breaks near a transposition two spans of new



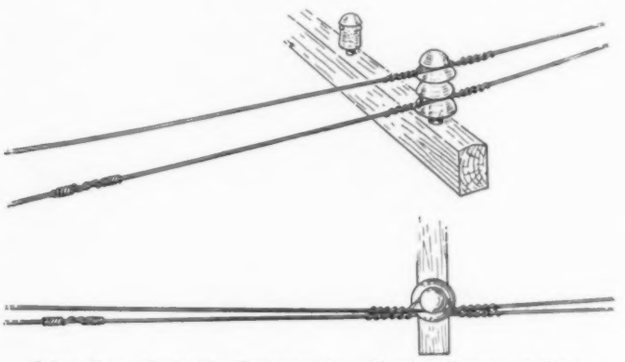
Bridle Wire Connections, Right and Wrong.

wire should be run in so as to carry the splice back to the next pole on each side.

The joint between bridle wires and iron lines is a fruitful source of trouble. Linemen say such a joint cannot be soldered. So they go to the terminal pole and wrap the bridle wire around the line innumerable times, but leave all turns unsoldered.

To get a good joint, the bridle wire should be given not less than five, nor more than seven turns around the line. The wrappings should extend along the line wire, inside the loop, not less than two inches.

This leaves plenty of room for the solder to flow in and make a solid joint. The first two wraps of the bridle wire should be left unsoldered. This allows

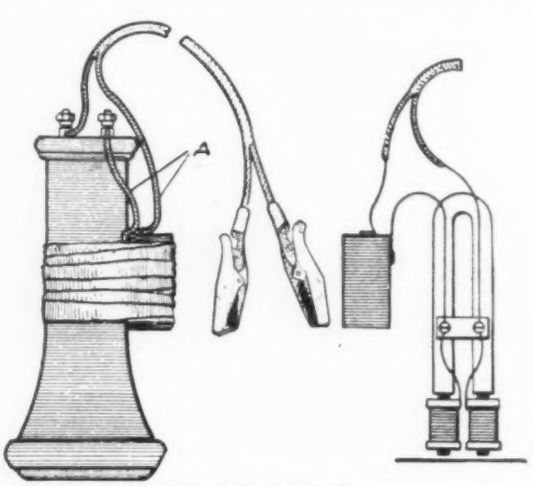


Splice Near Single Pin Transportation, Showing Danger of Cross.

the unsoldered turns to take up vibration; otherwise there would be a risk of breaking the bridle wire at the point where it runs in to the solder.

A Simple Ground Testing Outfit

AN inexpensive and compact equipment for testing for grounds can be easily made from a telephone receiver and a cell from a flashlight battery, says F. F. Sengstock, in *Popular Electricity.* Solder connections to the cell as shown in the illustration, then tape the cell securely to the receiver using ordinary friction tape. On the ends of the flexible cord provide two clips. When one clip is connected to a conductor and the other clip attached to a water pipe or ground,



Ground Testing Outfit.

the receiver will give a sharp click if the circuit is completed by a ground upon the wire tested. If the wire is perfectly insulated no sound will be heard in the receiver.

The calls resulting from births are more trouble, says a report, because these are limited to women, and the conversation occupies much more time than in telling of a death.

Meeting Public Requirements

By William Dunton Kerr*

CO-OPERATION TO MEET PUBLIC REQUIREMENTS.

THE public character of the telephone business is no longer seriously questioned by men prominently identified with the industry. The nature of the public interest in service, rates and efficiency is generally recognized. There is evident on all sides a frankly expressed desire to make all reasonable efforts to comply with reasonable public requirements. It is one thing to feel the need of co-operation with the public and another thing to put one's business in a position where co-operation may be practically accomplished.

Certainty the First Requisite.—The one chief requisite to a satisfactory compliance with public requirements is certainty in every phase of public relations. The public demands facts today where formerly opinions sufficed. The great effort of the telephone industry should be to remove from the realm of opinion, speculation and doubt as much of the subject matter of public relations as possible. Problems of service, rates and efficiency need to be placed on sound foundations of fact. When reasonable men of integrity, representing the different parties in interest to any such problem, come together to consider the public and private rights involved, the scope of the exercise of individual opinion should be narrowed to a minimum. This is as important when the company seeks relief from onerous conditions as when the public demands service improvements or rate reductions. Too frequently the public is asked to accept the opinions and explanations of public utility managers unsupported by convincing arrays of facts. The results are not beneficial to the utilities nor to the public. The facts are fundamental. They must be deduced, properly correlated, classified and rendered available for public use.

1. SERVICE.

Service Standards Desirable.—Standardization of service is highly desirable in meeting public requirements for first class service. Standardization cannot be accomplished in a short space of time, but in order to make the most satisfactory progress a start should be made early. A code of regulations is needed governing important service conditions with which the public is familiar. Such a code need not represent the best thought and the best practices known to the industry; it should establish reasonable standards for future observance. It is scarcely possible, nor is it necessarily desirable, that observance of the code be made obligatory. Its adoption should be a matter of self-interest with individual companies. The protection it would afford against public misunderstandings of the quality of the service would cause practically all companies to subscribe to it and enforce it. Some of the subjects that might be governed by such a code are as follows: The arrangement of circuits affecting transmission and phonetic qualities; regulations governing the clearing of trouble; average length of time to answer signals on a manual board on the first call and the recall; details of operators' conduct; methods of handling toll and trunked calls; arrangement of directories. The standards should be progressive, keeping pace with developments in the art. To some extent, equipment and apparatus with which the public is familiar might likewise be standardized.

The whole subject is one meriting organized effort of some kind, holding forth promise of many beneficial results to flow therefrom.

2. RATES.

System of Cost Analysis.—A method of cost analysis would assist materially in satisfying public requirements of reasonable rate schedules. Cost analysis is the only fact basis for ratemaking. What the service will bear is largely a matter of opinion and speculation in every case, upon which no satisfactory conclusions can ever be held for long by contending parties. A cost system of rate adjustment can be installed which will eliminate to a large degree the element of personal judgment and opinion in ratemaking. A cost system means the largest known degree of certainty in ratemaking. If it is founded somewhat on speculation and hence lacks certainty, it at least possesses the virtue that the facts adduced make the speculation highly intelligent. Because absolute certainty may not be obtainable the largest possible measure of practical certainty should not be scorned. Cost analysis affords the only logical basis for the justification of charges. Telephone companies must be able to justify their charges in the aggregate and in detail in order to satisfy public requirements.

Operating Systems Differentiated.—Cost analysis requires the drawing of sharp lines between individual operating systems. Exchange service is local; toll service is general. The one is confined to particular business and social communities; the other bridges the gaps between different communities. The two overlap in places, but for practical purposes and from a rate standpoint they are distinct. Local charges bear no necessary relation to toll charges, and vice versa. Each exchange system, from a service standpoint, is a separate utility. The toll system is another separate utility. The rates and charges applicable to each must be separately justifiable, both in the aggregate and in detail. The cost accounting system must comprehend this requirement.

Cost System Based on Service Characteristics.—A system of cost analysis must reflect service characteristics. The public interest goes to the service; the rate is applied to the service; the cost system must relate to the service. From a cost standpoint, the service is characterized by the relation that exists between the opportunity afforded to use the telephone facilities and the use actually made thereof. For the purposes of cost analysis, expenses which are dependent upon the quantity and character of use should be separated from the expenses which are independent of use. Certain non-use costs have their origin in definite, distinctive and common service factors, such as lines, stations and subscribers. The costs incident to each of these factors likewise need to be segregated. Finally, all expenses not directly related to one or

*Part V. of a paper entitled "Public Relations of Telephone Companies," read at the Fourteenth Annual Convention of the National Independent Telephone Association. Copyright, 1911, by Wm. D. Kerr.

another of the active cost and service factors should be classed by themselves for distribution on a fair basis among the classes of direct expenses. To this end the investment must similarly be analyzed and classified with reference to the important cost and service factors.

Complete Record of Service Factors.—Given the service costs analyzed and classified in the manner just indicated, an accurate record of the service factors themselves is needed. Thus a record is needed of the quantity and character of the use of each class of service, the number of lines, stations and subscribers in each class. By applying these data to the respective groups of expenses it is possible to distribute the service costs fairly and equitably among the different classes of consumers, and thence among the individual patrons of the service.

Justification of Charges Possible.—Rate schedules prepared with reference to an anlysis of this character are capable of ready justification. If the methods employed are correct and the fundamental data used accurate, no reasonable objection can be taken to a rate schedule prepared in this manner. In support of such a schedule the public can be approached with certainty of a generous reception. The public is fair. Opposition to public demands, supported by a detailed analysis of service costs, commands respect and carries weight. A cost foundation for rates should afford the largest public satisfaction and the freest possible extension of the service.

3. EFFICIENCY AND ECONOMY.

System of Unit Cost Comparisons.—Efficiency and economy can best be secured by the institution of suitable accounting and statistical methods. The system needs to be one which will enable unit cost comparisons to be made freely and intelligently between different operating systems and from year to year for the same operating system. Service lines should be followed in efficiency practices as in cost accounting for rate purposes because of the ultimate bearing of the subject on rates. The foundation for the study of efficiency and economy is the service. The smaller cost units that are necessary to permit intelligent consideration of the subject should bear proper relations to the service. Cost units should correspond closely to service units. The completed service is the same in every locality and under every possible method of producing it. The fundamental operations are everywhere and always the same. To fill the requirements of efficiency and economy the accounting system should be functional and should be based on the service rather than the investment.

Classification of Operation.—In the chronological order in which they are taken, the distinctive operations contributing to the completed telephone service are as follows: Central office operations; wire plant operations; sub-station operations; commercial operations; general operations; depreciation operations; tax operations; reserve operations; profit operations. The accounting system and statistical processes may well observe this fundamental classification. Accounts may be kept regularly on this basis, and unit costs for each important step in the several operations may be regularly compiled. In this manner accurate checks may be kept on the efficiency and economy of the several operations. This is not an easy task for the smaller companies, but the benefits that may result from an intelligent use of the data collected are numerous. As properties increase in size, labor differentiation becomes more minute and the distribution of expenses is thereby greatly facilitated.

Uniform Practices Desirable.—Uniformity in accounting and statistical practices will assist materially in satisfying public requirements for efficiency and economy. With the establishment of suitable clearing houses for data of this character, it is possible for properly conducted companies to present to the public convincing arrays of facts in support of contentions made in their own behalf and in answering criticisms directed to them. Efficiency accounting on a broad scale produces statistics of inestimable value to telephone managers in fulfilling their duties to stockholders and the public.

4. UNIFORM ACCOUNTING.

General Principles of Uniform Accounting.—It is beyond the scope of this paper to enter upon a discussion of the details of an accounting system which will enable telephone companies to satisfy public requirements for certainty in rate matters and in efficient and economical operation. A few general principles may, however, be set forth to advantage. In the first place, no system is justifiable which is not equally useful from a rate standpoint and an efficiency standpoint. The two need to go hand in hand. The interests of the one should not be subordinated unduly to those of the other. The following rules may be useful in developing a uniform accounting system, bearing the foregoing principle in mind:

a. Each individual operating system needs to be separately accounted for. Separate accounts need to be raised for the operating revenues, operating expenses and direct capital investments of each exchange system and toll system.

b. Operating revenue accounts must contain no items of revenue not associated directly with the public service.

c. Operating revenue accounts need to be classified (or if not so classified they should be capable of ready analysis) so that the revenue yielded by the rates for the important classes of service in every operating system may be ascertained.

d. Operating expenses should be classified uniformly for all exchanges and all toll systems according to the relation of the detailed expenses to the completed service. The arrangement should be functional and should be rigorously adhered to. The principal accounts for the smaller systems may be subdivided for the use of larger systems, preserving always the integrity of the characteristic groups.

e. No single account may be permitted to contain expenses affected by use and expenses not affected by use. Service rendered expenses must not be confused with readiness to serve expenses.

f. Expenses independent of output need to be classified with reference to the cost factors upon which they are primarily dependent.

g. Investment accounts may be classified with like regard for the service functions performed by the different units of plant and equipment.

h. Maintenance and property accounts should be classified substantially in the same manner.

5. PUBLIC REPORTS.

Publicity of Reports.—Many public utilities publish regular reports of their business. These may take the form of reports to stockholders which are published more for their benefit than for the information of the

public. Formal reports are often required to be made to municipal or state authorities. Whenever such reports are likely to receive wide publicity, careful attention deserves to be given to their form. Falling, as they are likely to, into the hands of persons unskilled in the interpretation of such reports, they may disseminate dangerous misinformation about the business instead of information. Newspaper and other publicity agencies have been known to use such reports in unwarranted fashions with telling effect in campaigns against public service companies.

Report Service, Not Investment.—Published reports need to be drawn with particular reference to their effect in presenting the business to the public. They should report the service rather than the investment. The investment feature of the reports is important and necessary, but in some respects it may well be subordinated to the service feature. A broad, general distinction may be made between accounting and reporting for investment and accounting and reporting for service. The moment the public interest attaches to the service and the investment, the service aspect deserves to be put forward prominently. This need not detract from the value of the reports for investment purposes; in fact, a satisfactory service report may be the best kind of a conservative investment statement.

Arrangement of Investment Report.—In the usual financial statements of telephone companies the items included under the head of operating expenses are confined to current expenses incurred in the use and up-keep of the properties and in the general conduct of the business. These are the expenses over which the management as such has direct control, and for which it is chargeable. In an entirely separate division, expenditures of a contractual nature representing usually carrying charges on capital are displayed. Taxes are sometimes reported as a charge to operating expenses and sometimes to the so-called fixed charges. In many instances depreciation is represented as a charge against net income, or the balance remaining after meeting operating expenses and fixed charges. From an investment standpoint this may be logical and correct. Direct expenses of carrying on the business must be met first of all, and the balance of revenues after meeting these obligations is a matter of importance. Fixed charges are then deducted in order that the amount of unclaimed income, or income against which no rights have accrued, may be determined. The free income may be devoted to any lawful purposes which meet with the approval of the proprietors. The amount of free income is often the most important item in an investment statement.

Investment Statement Misrepresents Service.—However correct and logical this method of representing the business may be, from an investment standpoint, it is hardly correct from a service standpoint. This form of report does not show concisely and completely the cost of the aggregate public services performed. It should do so. Operating expenses from a service standpoint include all the costs of the service, whether pertaining to current operation and maintenance, carrying charges on capital invested or necessary appropriations from free income. No statement of the cost of the service is complete without the inclusion of all such items. It invites criticism and misunderstanding of the burdens of the service to publish reports solely for the information and guidance of investors.

Character of Service Report.—The cost of the service includes taxes, return on investment, depreciation, necessary reserve charges, and such other expenses as are indispensable to the proper conduct of the service. Published reports need to make this clear to the average reader. Telephone companies usually carry book accounts, at least, to show the supposed indebtedness of the service to depreciation. A similar account might well be opened for return on investment, through which a direct charge might be made against service revenues in the published reports. If properly handled such an account would serve a useful purpose and would prejudice the interests of no one. Its effect would be to give recognition to an indebtedness of the service which is not always met as it should be. Telephone companies owe it to their stockholders and to the public to make their services stand out clearly in their proper relations in the reports and other publicity material put in the hands of the public.

Government to Investigate Chicago Depreciation

The Chicago Telephone Company is to be subjected to an investigation by the United States treasury department. Officials of the bureau of internal revenue who are engaged in spreading the federal assessment of corporations want an explanation of an item which appears in the telephone company's affidavit of receipts and expenditures on which the tax is computed.

The item in question is the depreciation charge for 1910, which appears in the schedule to be more than double the company's depreciation allowance in 1909.

This increase of the depreciation account results in reducing the apparent net income about $800,000, although the company did around $1,300,000 more business in 1910 than in 1909. The result to the government is about $8,000 less in taxes from the Chicago Telephone Company in the event the increased depreciation item is allowed to stand.

Bernard E. Sunny, president of the Chicago Telephone Company, when informed of the prospective federal action, said the corporation would welcome an investigation.

"The matter is simple," he said. "The difference in net income between 1909 and 1910 lies in the larger charge to depreciation. W. J. Hagenagh, the city's expert, recommended several changes in our bookkeeping system, this among them. If our efforts to conform to his suggestions fail to satisfy the federal government it is not our fault. Certainly we will welcome an investigation by the government."

Public Utilities Law in Ohio

The Ohio public utilities bill became a law without the governor's signature, effective after June 30. It is stated he was unwilling to approve the section allowing the consolidation of telephone companies with such capitalization and rates as the Public Service Commission may fix, but at the same time did not wish to assume the responsibility of vetoing the section, so allowed it to become a law by the expiration of the period fixed by law.

All public service corporations will be subject to the regulation of the State Railroad Commission, under the name of the Public Service Commission of Ohio, with the exception of local utilities over which the commission can exercise no power unless appeal is made to it.

A High Power Transmitter and Repeater

By Charles Adams-Randall

IN the application of any power, the work done depends upon the energy expended. With the telegraph, electric energy is used as required; it is practically unlimited, with the result that all distances are annihilated and "a girdle has been put around the earth."

With the telephone of today, the current energy employed is limited; of very low power; as one to several hundred, when compared with the telegraph.

After thirty-five years' application, this lack of power is the great weakness and defect of the telephone, and the main fundamental problem of the telephone is the utilization through the medium of the telephone transmitter and apparatus combined therewith of current energy in proportion to the work to be done.

There are, of course, other incidental problems connected with long distance telephone transmission, such as those due to induction, capacity, distortion, etc. These, however, have been met largely by the practical engineers in the actual application and use of the telephone, and I need not at this time dwell thereon, simply stating that the solving of the greater problem largely if not positively solves the lesser ones.

In practice, the present long distance transmission has been obtained by reducing the resistance of distance, regardless of cost, by constructing transposed, low resistance circuits of costly copper wire—in other words, adapting the circuits to the obtainable low power or present transmitters.

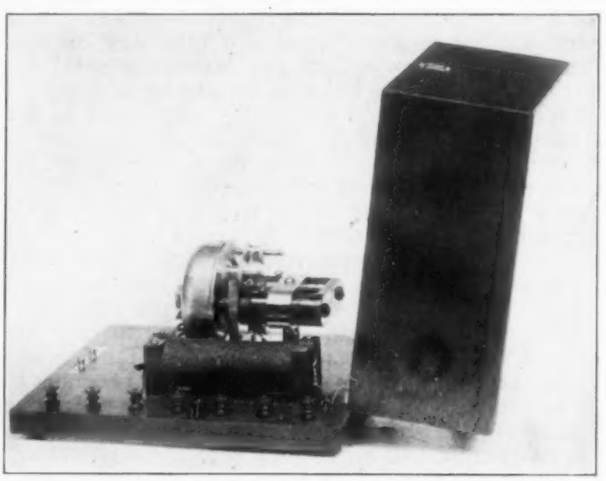
Recently it has been attempted to augment the power used in transmission by the introduction in the

Professor Charles Adams-Randall.

circuit of so-called repeaters or "boosters." This, it is alleged, serves slightly to augment, by supplementary induced current effects, the main talking current passing over the circuit, in which this apparatus, the secondary of the induction-coil at the transmitting station, and the receiver at the receiving terminal are all included.

This class of instrument is operated and controlled by the voice currents of telephonic transmission, and is therefore limited in power; in distance of operation; and does not repeat from one independent circuit into or over another, as with the "telegraph repeater."

As to the percentage of gain with this instrument, telephone men vary materially, owing probably to the fact that *line conditions* of long distance circuits are



Randall Telephone Switchboard Repeater.

seldom the same. Whatever the percentage of gain or efficiency may be, however, it adds little to the solution of the long distance transmission problem, as its object is to better the transmission on present circuits.

One of the theories advanced and accepted by many telephone engineers, relative to the limitation of speech transmission, is that the telephone currents become distorted, flatten out, or change in character over a long distance circuit, whereby the characteristics of the current impulses or waves, started at the initial point, and corresponding to the air waves of speech producing them, are distorted and do not faithfully reproduce the spoken words at the distant terminal of the circuit.

Undoubtedly, under certain conditions this is absolutely true. It is also true and readily proven, that "distortion" occurs on short circuits, when using an imperfect transmitter, or too much current through any transmitter.

It is also true and readily proven, that transmitters that absolutely make or break the circuit, at the transmitter—the spoken words not being intelligible in a receiver at the transmitter—are faithfully reproduced at a distant station, without harshness or distortion.

These facts prove that "distance" is not the only element to be considered in connection with "distortion."

One of the recent methods and means for overcoming or preventing the change in character of the voice currents on a long circuit, is the well known "loading-coil" of Prof. Pupin. The object sought is

to keep the characteristics of the electric waves passing over the circuit unchanged, that they may correspond to those started at the initial point as nearly as possible, when arriving at the reproducer or receiver. Whatever the gain may be, it is obtained by increased cost of circuit construction.

It is but a few years, comparatively, since it was considered absurd to think the telephone would ever transmit speech one hundred miles. We are at present only in the A B C of this science.

I have found and proved that the limiting distance of speech transmission depends almost entirely upon the current energy utilized in the circuit. Men, animals, and auto-cars balk or fail if given too much work to do. It is the same with electrical energy. Let me illustrate this:

In telegraphy, rapid and reliable transmission is obtainable over a given circuit in clear weather, but in stormy weather the apparatus used becomes "sluggish" and uncertain in operation, simply for the want of power to do the work. Instead of installing "loading coils" or reconstructing the circuit, additional energy is supplied, and reliability is obtained.

The increase of power will be as applicable and efficacious in telephony, when we learn how to apply it. This statement will be accepted by anyone who will consider the following facts, based on Ohm's law.

Given a telegraph circuit of 500 miles at say 20 ohms per mile—10,000 ohms—and assuming that current at 300 volts is used, and we have a working current of 9 watts. If this is insufficient for reliable work, we use say 400 volts, which gives us 16 watts, this increased power enabling us to perform the work reliably.

With the telephone transmitter of today, having a normal resistance of 10 ohms and using a 6 volt current, we have a normal effective working current of 3.6 watts. If we increase the voltage to 12 volts we have a normal effective working current of 14.4 watts, and as in telegraphy this must, if properly used and applied, give us increased results. Where is the limit of power that may be used with a properly constructed telephone transmitter?

In my researches and efforts relative to the solving of this great telephone problem, covering over twenty years, I have attacked it from the standpoint that electrical work can only be accomplished in proportion to the electrical energy utilized. On this basis I have given much thought, time and labor in developing telephone apparatus with which current energy can be used in proportion to the electrical work to be done.

This has resulted in the perfecting of the Randall "high power transmitter" and in combination therewith an "automatic telephone repeater" having realized that in profitable, practical, commercial use there must be a limit to direct transmission—as in telegraphy—and that telephoning over unlimited distance can only be successfully accomplished by automatic retransmission of messages.

In this combination, and for the objects set forth, I have followed as closely as the widely different systems will permit, the successful methods of telegraphy.

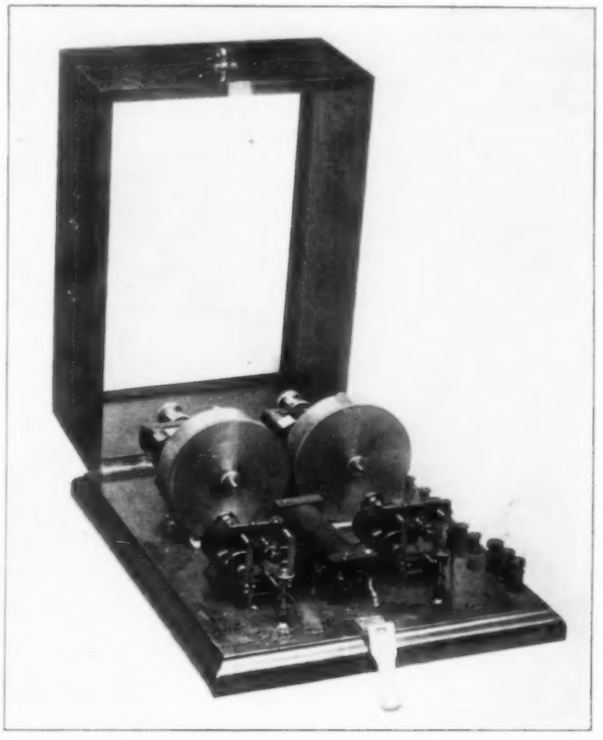
In this connection I will undertake to give a description of these inventions.

* * *

The Randall high power transmitter combines the variable resistance, preferably carbon granules, under pressure, by means of a vibratable non-conducting diaphragm, in contradistinction to the present method in which the carbon granules are held in a loose free state, and the speaking contact obtained by the weight of the loose granules.

Under the method of construction a low normal resistance is obtained that permits the use of a low power current energy and also affords a greater conducting capacity for any increased energy therethrough, and generally in proportion to the cross section and subdivided mass of granulated carbon or variable resistance when confined under pressure.

With instruments of this class, a current energy may be employed equal to that now generally used with granular transmitters, and when required a current energy many times greater than is now possible is utilized without any change in construction or adjustment, and with proportional increased efficiency.



Randall Automatic Telephone Repeater.

The maximum current energy that may be used is not now known, but with instruments in use the power is increased three, four or more times over that of present transmitters. This increased power means increased distances of operation, which has been proved on actual telephone lines.

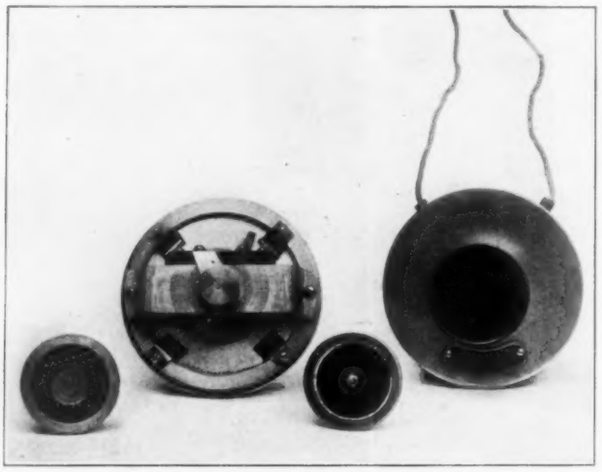
It also means that present costly low resistance circuits can be duplicated at reduced cost by the use of smaller copper or iron wire. Assuming from a profitable commercial basis, taking into consideration the various details of practical telephony, such as current consumption, cost of circuit construction, electrical troubles arising from induction, leakage, etc., that the distance of direct transmission must be limited to 1,000, 2,000 or 3,000 miles, it naturally follows then that to double, treble, or more, this assumed maximum distance, the messages must be retransmitted or repeated manually or automatically.

As manual retransmission is impracticable, an automatic telephone repeater becomes an actual necessity if the telephone is to have as wide a scope as the telegraph.

The Randall automatic telephone repeater's operation and control is not effected by the action of the voice-caused currents as heretofore, but utilizes a battery or other current of far greater energy, and is therefore operative on longer circuits and more efficient on present maximum circuits, and adapted to uses not heretofore possible. It bears the same relation to telephony that the telegraph repeater does to telegraphy.

This invention has for its object the retransmission or repetition automatically of telephone messages from the terminal of one circuit into or over a second independent circuit, and from a second circuit to another or other circuits, similarly as telegraph messages are automatically retransmitted.

The essential elements are electromagnetically operated telephone transmitters of special construction, and electromagnetic controlling devices, the operative parts being in duplicate, one-half being in



Randall Long Distance Transmitter.

one circuit, and the other half in a second main line circuit or a local circuit when used as a relay.

The electromagnetic transmitters are actuated by the voice currents passing from the distant transmitting station over the circuit of which it is a part, and serves to retransmit automatically the spoken messages into or over a second or other circuits that are separate and distinct from the circuit over which the messages are primarily transmitted.

The repeater transmitting apparatus comprises the transmitter, electromagnetically operated, a suitable transformer, and a local battery, normally open, that is connected in circuit through the action of the electromagnetic controller.

The controller of the apparatus is of the telegraph relay form, and acts to make or break automatically the line and local circuits connected to the circuit-closing device of the controller.

The controller is actuated by a current energy far greater than that of the voice current heretofore used, such as a current from a proper main line battery in circuit therewith, or preferably by means of a local battery in circuit with the electromagnet of the controller. In this last described arrangement the action of the local battery and the controller is determined by the action of a suitable relay included in the main line metallic telephone circuit, at or near the repeater, or in one side of the metallic circuit grounded.

The latter arrangements overcome all trouble from bridges on the metallic circuit. With bridged metallic circuits, however, it is only necessary to install a suitable condenser in the bridges.

The main line battery for actuating the controller when it is in the main line, or for actuating the main line relay is included in the main line circuit at any convenient part thereof, as a whole, or may be subdivided, with one portion at the repeater and another portion at the distant terminal station or otherwise.

The main line battery is normally open and may be closed manually at either of the terminal stations as required. It may also be automatically controlled at either of the transmitting stations, by the act of speaking into the transmitter through the medium of intermediate devices for and upon which patents are now pending.

The object of the controllers is to select, determine and control the main line and local circuits and the local batteries. The controller when active or energized, of one of the main lines, say the east line, serves to close the local battery and circuit for the east line repeater transmitter and also the west main line circuit for either sending or receiving as required, and the call apparatus.

The controller for the west line operates similarly for its circuit and devices.

Under this arrangement and combination of circuits and devices, the two transmitters of the repeater cannot operate simultaneously and therefore "humming" or "singing" is absolutely prevented, and the necessity of balanced circuits and frequent readjustment of the apparatus, as heretofore required, is entirely overcome.

The electromagnetic transmitters are operative with the current obtained from any good granular transmitter, on any circuit over which speech can be transmitted commercially with such transmitter up to the present maximum distance, and when thus operated will retransmit into a second separate circuit of equal or greater distance.

With transmitters of greater power or efficiency, such as the Randall type described, the distance or length of circuit from the terminal station to the repeater can be proportionately increased.

The automatic repeater therefore serves to double the distance of the primary or first circuit by repeating into a second circuit and with a repeater at the distant terminal of the second circuit, the message can be automatically retransmitted into a third circuit with an auxiliary power equal to or greater than that of the manually operated transmitter at the first terminal, whereby, as in telegraphy, transmission is possible over thousands of miles, as efficiently as now accomplished by direct transmission with voice operated transmitters on circuits of 1,000 miles, more or less.

On long toll lines composed of cable and aerial lines, with the automatic repeater intermediate the cable terminal and the aerial portion of the main line—thereby cutting out the retardation effects due to the cable forming a part of the toll line—distances now operated over can be doubled or more.

With the repeater used as a "relay" at the terminal of a circuit the volume of tone at the receiving instrument is greatly augmented, and the barely commercial speech by direct transmission becomes as distinct and as reliable as on telephone circuits of moderate length.

For telephone exchange uses, on subscribers' and toll lines where the transmission is unsatisfactory, this invention is especially applicable and with its use intercommunication is made more reliable; distances increased, and phantom circuits more efficiently operated.

In this application the apparatus is greatly simplified, reduced in size, and of moderate cost, the automatic controller means and other parts being eliminated, the operator at the exchange, in connecting two subscribers together through the switchboard, simultaneously connects in the repeater, and its line and local circuits, batteries and connections.

There are many other applications to which this invention is adaptable that I need not now dwell upon, the most interesting feature being the improvements effected generally in telephony that bring it nearer telegraphy.

What One Woman Thinks

By Sarah Elizabeth Brown

OBEDIAH found a particularly comfortable spot in the porch hammock one cool evening about a week ago, and while I sat and rocked he swung and smoked. After the local gossip of the day had been gone over, he drifted into telephone topics. "Lib," he said, "these independent telephone makers seem to be gathering around the same old battle-scarred sentimental flag for a final stand. They're showing considerable activity and strength on paper, but I'll be dinged if I believe they can get away with it. There is too blamed much bunk in such a program. There ain't no sentiment left, at least among operators. We're out for the almighty dollar, just like our brothers in other walks o' life, and we're pretty apt to buy the goods we need on their merits and their price. All things being equal, we'll buy the stuff we are acquainted with, but the price is bound to have some effect. It strikes me that if competition in the business is so all-fired necessary, these manufacturers show a white feather by putting all their ads in one place. They storm us from every quarter that competition is great. Why, you can remember when they thought competition was so good for us that the farmers in Petry township were encouraged to start a little system of their own. We took it over when they got tired of the experiment, and we got it cheap. For one, I'm out of patience with this sympathetic, sentimental thing."

I tried to defend the independent manufacturer by showing an ad that said interconnected system meant that the independent exchange had to buy its apparatus from the Bell factory. Obediah simply said: "Shucks, there ain't nothing to it! Why, confound it, Lib, do you reckon a policy like that could hold when the United States attorney general is scouting around for trouble among the big corporations? Do you think the independents themselves haven't got sense enough to fight shy from such an arrangement?"

Well, we argued on along these lines till the mosquitos got so bad we had to go in. Personally, I'm leaning Obediah's way. He got the best of the argument. I'm sure competitive telephony can be made a sensible business, because, as I've said time and time again, no single operator can hope to do the telephone business of this country, and no single manufacturer can hope to make all the apparatus. And what's more, I don't think the Bell company has that notion.

But the independent manufacturer doesn't seem to enthuse on this point. He shows a mighty narrow conception by clinging to sentiment; encouraging its spread and bolstering up the old cry.

The "fight it out" spirit isn't striking terror as it used to. As a matter of fact, the independent manufacturer of manual stuff has found the going rather rough ever since the big Bell factory sent its salesmen into independent territory. Thinking back, as any of us can, these same manufacturers exhibited many shortcomings when they had things all their own way. They were always wrangling with each other—fighting infringements of patents; indulging extravagant litigation; cutting prices. To be sure, they improved apparatus; brought it to a nice state of perfection, and all that; but they enjoyed a field without competition except among themselves. They were "good fellows together," but deadly enemies when apart. They would "do" each other to land an order, every time, and even to this day, every salesman we meet has it in for the "other house."

If this is the way to handle the situation as it is presented today, I'm a poor judge of business practice. You can strain a customer's patience just as easily as you can strain circumstances. The circumstances right now appear to be against the method of operation. But, after all, I can't do more than console myself that these "vaporings" will blow away without getting anywhere.

* * *

Cheer up, you fellows who are complaining about close times. During the month semi-annual interest and dividends will be paid and the amount is set down at approximately $220,000,000. This estimate is based upon an aggregate of $7,000,000,000 worth of bonds of every description. Practically all of the money is payable through New York banks and trust companies.

* * *

It takes a lot of patience to sit still and wait for things to happen. I have been reasonably consistent in my insistence that telephone securities were sound. Take the whole fabric and it will rate higher than most industries. Whether by a fixed method or not, there has been countless thousands of dollars turned back into operating plant. If an occasional unit of system has been milked—its receipts diverted to dividends and extravagances of mismanagement, it is the exception rather than the rule. Telephone systems of this country represent all that stock and bonds call for, and more.

That's why Cuyahoga and U. S. Tel. bonds are soaring in Ohio. The mere fact that J. Pierpont Morgan & Co. own both companies has nothing to do with it. They were cracking good concerns long before Morgan heard of them. And I'm sure that the anticipated consolidation of these companies with the Bell system has little bearing on the case. Consolidation may be inevitable, but it won't be very soon. There is too much property involved to hurry negotiations. The point I wish to make is the genuine stability of telephone securities. Cuyahoga's annual interest charge is $163,000. U. S. Tel. is $107,000. Cuyahoga earned a net of nearly three times its interest charge and U. S. Tel. nearly double its interest charge. The day is coming fast when no one will have to beg for buyers for telephone securities.

* * *

The Supreme Court decision in the big trust cases didn't seem to clear away all the obstructions. The "list" seems to hold its own with considerable effort. Market hesitancy is explained by technicalities. Nothing loosens fast. We stick.

Lack of confidence doesn't explain things. Hogs at 5⅜, when last year we were getting 9 right here on the farm, miles and miles from market! Something rotten with the stock list, eh? I wish the truth would come out now, quick. Do you believe the newspapers of this country are free and untrammeled? I don't. Newspapers are cowards in times like these. They bend their knees in abject fear of the powers. The best stories are never told.

A little while ago there was a great spread about the president of a railroad appealing to employes to save five cents a day. Gr-reat! Not a word about private cars and the retinue of servants for the officers of the road.

John has finished his freshman year at Case College, Cleveland, and his chum happens to be the son of a big railroad official. He learned from his chum that papa's railroad is practically a bankrupt—that it is firing old and trusted men by telegraph; that it is repudiating its injury claims; carrying on something terrible. Now you can't tell me that newspapers don't know these things. We wonder at the appeal of railroads for a larger freight rate. Railroads may need it, but when they will lop off the private cars and the ridiculous salaries of the men higher up, then the freight schedules will look better.

This is only one thing that is the matter. Everything has been going helter-skelter. There must be readjustments and when men are busy finding new fulcrum points they haven't time to buy. They skimp and hoard. We all suffer. Money freezes up in the vaults. Banks must be shown through a higher power magnifying glass, and things dilly-dally. Economic readjustment is a pet phrase today in nearly every blooming industry but telephones. And believe me, brothers, I'm willing to stand for it. The country is all right, but economic readjustments are quite essential if we must toady to the stock list.

* * *

Judged from present indications, state commission regulation will help to solve some of the telephone companies' knotty problems. I have several cases before me this month that seem to emphasize this. The Federal T. & T. Company of Buffalo has been authorized by the New York commissioners to issue $578,000 five per cent bonds upon the security of its mortgage dated March 24, 1909. It would seem that the Federal wants the Niagara Home company, the Dunkirk Home company and the Independent Union company, the latter being a long distance operator in territory west of Syracuse. Here are the commissioner's sensible conditions: To acquire the Niagara, Federal bonds to the amount of $364,800 par value may be issued for the purchase of the entire outstanding issue of bonds of the Niagara company which amounts to $456,000; or 80 per cent Federal for 100 per cent Niagara. Of the total Federal issue, $64,000 will acquire the Dunkirk property, the exchange basis to be par for par. The express condition imposed in the Independent Union deal is a clear title to that property and no liabilities. The price Federal will pay is $150,000 of its new bond issue. Doesn't this have the ring of careful analysis?

* * *

In Wisconsin the Brooklyn Telephone Company will be permitted to raise its rates from $18-12 to $21-15, when it gives continuous service. The commission denied the company's appeal for the new rate on the old basis of partial service. The testimony before the commissioners developed that the company had been paying six per cent on its capital stock, but had not provided adequately for depreciation—a common fault. The Wisconsin commission presumes 6½ per cent or 7 per cent is enough for depreciation, but it is certainly not too much.

* * *

In Ohio the new utilities law declares that telephone companies are common carriers. It also places all consolidations and mergers in the state commissioners' hands. The commission also has the final say respecting all agreements, contracts, leases and other forms of combinations. Physical connection is compulsory "between localities, but not within municipalities, except for long distance purposes." The commission also has the power to require joint use of poles, wires and other equipment within municipalities when necessary to the public convenience, "on condition that such requirement does not work irreparable injury to the company upon which such demand is made." The Ohio law seems to be planned for consolidations of telephone systems and the commissioners have as much power in all matters as a law usually confers.

* * *

The newspapers are beginning to poke fun at the Michigan public utilities bill, charging that it was made possible because of the farmer vote in the legislature. Chide a farmer and you surely get in wrong with me. If the farmer vote in the Michigan capitol was a factor in the state's new laws, they are doubtless pretty good laws. The Giles bill in Michigan, now become a law, declares telephone companies to be common carriers and it puts the problems into the state commissioners' hands. A farmer's telephone patronage is as good as any other man's and if the farmer legislates a toll connection upon himself that ought to be his business. The credit of the farmer is something most town folks are looking for and we find what little loss we have on our books always due to every other man than the farmer. If you want to get me riled, just start something about the farmer. Somebody else in Michigan must have a grudge against the new law.

Some Questions Answered

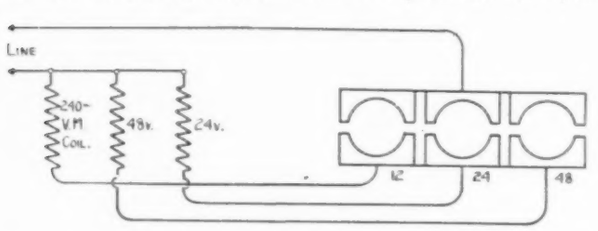
By J. C. Slippy

[This department is at the command of our readers. Questions relating to all branches of telephony—technical, financial, ethical, or otherwise—are invited, and will be answered in the order received. Answers by mail, if requested. Names of inquirers will not be used unless desired.—*Editor.*]

VOLTMETER WINDING.

Enclosed find a drawing of a voltmeter, measuring 12 volts, and wound 20 ohms per volt. The arrangement I wish to accomplish is to use this meter on 24 and 48 volts, by means of shunt coils, but do not know if it is advisable, and if so what resistance to make the coils. My line of work calls for these different voltages in my daily routine, and if I could carry out the plan mentioned it would be a great convenience. If you deem my plan advisable, please give me the resistance of the two coils needed and also the address of the manufacturer from whom I can obtain them. In regard to the exact resistance of the coils, I am not particular, as the measurements I make on the 24 or 48 volts in a few cases need to be fairly correct. The general use I will make of the test set is locating crosses, grounds, etc., and only use the meter as a convenient method of testing, as I can work on the trouble, and watch the meter, where, if I used a receiver I could not always tell, especially when the trouble was intermittent. I should like to find out if my plan is practicable as soon as convenient, as I need some way of testing, outside of a receiver.—J. W. N.

By using three separate coils, connected as you have suggested, it would be necessary to make the one you wish to use on the 24-volt circuit of 480 ohms resistance and the one on the 48-volt circuit of 960 ohms, each being wound 20 ohms per volt and cut in on the line when required by means of plugs. The reading of your voltmeter scale would have to be multiplied by two for the 24-volt circuit and by four for the 48-volt circuit. A better way to handle your proposition would be to connect a 240-ohm and 480-ohm coil in series with your present coil, so that by means of a three-point switch you could build up your voltmeter coil as required. Using this method you would have a total resistance of 960 ohms in your coils, against 1,680 ohms by the first method. To use the voltmeter on the 24-volt work you would throw your switch so as to connect the 240-ohm coil in with the present 240-ohm coil, which would be the same as having a new coil of 480 ohms. To use it for 48 volts you would cut in the 480-ohm coil in addition to the two 240-ohm coils and you would then have a coil whose total resistance would be 960 ohms. It is possible that you

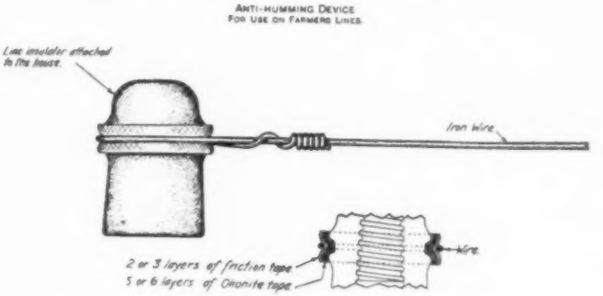


can wind these coils and rig up the switch yourself; if not, any of the telephone supply houses can furnish them. The present voltmeter scale must be multiplied by two when using the 24-volt circuit and by four when using the 48-volt test.

NOISY TELEPHONE LINE.

Will you kindly advise of a method whereby the noise on a rural telephone line may be eliminated? The line in question is a private line two and one-quarter miles long of No. 14 iron metallic circuit. The drop wires from the pole lead to the subscriber's house are twisted pair ironite.—J. L. S.

For the prevention of humming on farmer lines the last span should be strung slack. In case humming cannot be avoided by means of a slack span, an anti-


ANTI-HUMMING DEVICE
FOR USE ON FARMERS LINES.
Last insulator attached to the house.
Iron wire.
2 or 3 layers of friction tape
5 or 6 layers of Okonite tape
Wire.

humming device should be placed in the grooves of the line insulators attached to the house as shown in the figures.

FALSE BUSY TEST.

Please send or print answers to the following questions:

1. What will cause a false busy test at a "B" operator's position (Bell type common battery call circuit) and what is the quickest way to locate it? This usually affects all the cords on one position.

2. What is the 100 volt battery used for at test boards? (Bell type boards, Western Electric and others?)—W. F. C.

1. Foreign or improper local potential on the test wire will give a difference of potential between test rings and plug tips. A crossed test wire will also give a false busy test.

2. The voltage of the sending battery used at test boards is dependent on the length of the line and number of stations upon it, ranging in most cases from 100 to 300 volts. The length of circuit is from 25 to 300 miles, the number of stations varying according to the train traffic over the division.

INSULATORS AND TIE WIRE.

Will you kindly answer the following questions? In constructing telephone and telegraph lines, do you depend on the insulator and tie wire to keep the line tight? In case of contraction and expansion of the line, is it not unwise to have the line secured absolutely tight to the insulator? What are some of the bad features and difficulties involved in the insulators which are in use at present? Is the irregular height of line poles (on account of uneven country) taken into consideration to equalize the keeping of the line tight? Is the insulator depended upon to keep the line from slacking for quite a distance in case of the line breaking? You will oblige me very much by giving me this information.—T. H. W.

The general principles covering the construction of telephone lines are as follows:

In stringing line wires it is desirable that all wires in a span have a uniform sag. The sag for No. 10 B. & S. gauge wires should be as given in the following table, making the allowance therein stated for temperature and length of span. The sag for No. 12

B. & S. gauge wires should be at least two inches greater than that indicated in the table for the same temperature and span.

LENGTH OF SPAN IN FEET.

	75	100	115	130	150	200
Temperature.	*Sag in Inches.*					
−30°	1	2	2½	3½	4½	8
−10°	1½	2½	3	4	5	9
+10°	1½	3	3½	4½	6	10½
+30°	2	3½	4	5½	7	12
+60°	2½	4½	5½	7	9	15½
+80°	3	5½	7	8½	11½	19
+100°	4½	7	9	11	14	22½

The line wire is tied in the groove of the insulator by the tie wire which passes around it. The poles are generally so graded as to avoid an abrupt change in height of the line, which would result in a strain on the insulator. In cases where a considerable upward or downward pull on the insulator cannot be avoided, double tie wires may be used. The tie wire should be of the same size as the line wire and in tying, one side of the tie wire passes over the line wire and makes five complete turns and the other side passes under the line wire and makes five complete turns. In case of a break in the line, this tie will prevent the wire from slacking. The contraction and expansion is cared for by the sag. Allowance in the above table so that a tight tie on the insulator is permissible. Regarding insulator design, a factor is the path for surface leakage from the wire to the pin and crossarm. The moisture which collects on the insulator forms a path for leakage and the petticoat on the glass is to protect the pin and inner surface of the glass from moisture, as far as practical, and to afford a long path over the surface of the glass from the wire to the pin.

Chicago Electric Club Hears About Automatic

W. Lee Campbell, superintendent of the Automatic Electric Company, gave an address before the Chicago Electric Club June 7 on the history, development and advantages of automatic telephony in which he spoke of the difficulties which had to be overcome before the advantages of the automatic telephone were publicly acknowledged.

Although the first patents were granted in 1878 it was fully twenty-five years before commercial applications were made of it on a large scale. He regarded the persistent belief in the automatic by its sponsors, during this long period, as one of the impressive features in the history of automatic telephony.

Through the influence of Joseph Harris the manufacturers were induced to conduct an exhibit during the World's Fair in Chicago which was a great benefit in the development of this system, as shortly afterward the first automatic exchange was installed in Laporte, Ind. Five wires were necessary between each instrument and the exchange in this installation, each wire connecting a signal button, five push buttons being necessary to make a connection. An installation was made in Michigan City, Ind., in 1895 in which only two wires were necessary. Magneto signals and local batteries were employed for the talking circuits.

The calling device now used on automatic telephones was brought out in 1896. In 1903 exchanges were installed in Dayton, Ohio; Grand Rapids, Mich., and Chicago, a total of 20,000 lines.

The contract for the Grand Rapids installation called for a guarantee of the entire equipment for seven years, and if the equipment was not satisfactory to ninety per cent of the subscribers at the expiration of the contract the whole to be taken out. The contract expired last January and Mr. Campbell stated less than $1,000 was spent in repairs.

Mr. Campbell gave a brief review of the development of the automatic telephone up to the present time and also spoke of the advantages of the automatic telephone.

There are now 350,000 automatic telephones in use, Los Angeles, Cal., having the largest installation. The automatic telephone is also being introduced into European countries.

The Constantinople System

In May last a formal agreement was executed at Constantinople between Djavid Bey, at that time minister of finance, and Herbert Laws Webb, of London, looking toward the installation of a telephone system in the Turkish capitol. Messrs. F. Gill and W. W. Cook, engineer-in-chief and assistant engineer-in-chief respectively of the National Telephone Company, have been appointed consulting engineers for this project. A staff of engineers from London under the charge of John Scott will make a survey of Constantinople and prepare plans and specifications for the system, which is to have a present capacity of 10,000, and be ready for service in July, 1913.

The work presents many difficulties, due to the situation of the city, the character of its inhabitants and more especially to the fact that as no telephone service exists in Turkey there is no available data whereby to gauge the probable use of the service or the probable traffic which the system will be called upon to carry. The population is estimated at between 1,000,000 and 1,250,000 and as the present means of communication are so primitive and expensive a large demand for the telephone service may be anticipated.

The Telephone Development Company, Ltd., has been formed for the purpose of carrying on the necessary work, pending the organization of the Ottoman Telephone Company, which will construct and operate the plant.

Broader Uses of Telephony

Conducting a religious revival by telephone, lately reported from Malden, is in keeping with the increased utilization of that wonderful instrument, says the Boston *Herald*. Why not? The Salvation Army and similar organizations long ago decorated the rocks by the country roadside with such inscriptions as "Prepare to meet thy God" in the hope of arresting the attention of the indifferent wayfarer who never came within ear-shot of formal religious instruction. But his automobile now goes too fast for him to be impressed by this solemn message. Why should not a series of telephone talks, conducted individually with all who would continue courteously or contentedly to hold the receiver, be an effective way of reaching the unchurched? The element of privacy would happily be maintained. But this is only one instance. Life insurance agents are making their preliminary calls in this way. Representatives of business houses seek this means of access to prospective customers. Physicians are not only summoned by telephone, but they listen to reports from the trained nurse, and otherwise manage many a case over a wire. The telephone charge on physicians' bills has become a regular item. It is thus probable that the telephone is still in its infancy.

Digest of Foreign Telephone Literature

Translated for Our Readers

COMPRESSED AIR PLANT IN HAMBURG TELEPHONE EXCHANGE.

THE Hamburg, Germany, telephone exchange has installed a compressed air plant, which is to be used for testing cables and to remove dust from switchboards and telephone instruments. Originally a 2-horsepower portable compressed air plant was used. But this soon became too small, and at present a 10-horsepower stationary plant does the required work. As said before, this plant is used not only for cable testing, but also for dust removal from jacks, plugs, switchboards, for which purpose the forced blast of compressed air is far more useful than the vacuum cleaning system.

In the center of the telephone exchange, in the basement, are the machines for compressed air plant. The equipment consists of a 10-horsepower shunt wound electric motor, a compressor and the air vessel in which the compressed air, before entering conduits, is cooled and dried. From this central station, pipe lines run through the entire building. At the north end the line goes up to the various stories, from where connections are made with different rooms, and at the south a similar line runs downward to connect with cable conduits. As the air, when compressed, is too moist for use in cable testing, it is passed through a drying plant in the cable shaft, where it is first dried or desiccated before being used for testing.

The electric motor drives a double-acting cylinder compressor at 220 r. p. m. With a cylinder diameter of 150 mm. and a piston hub of 150 mm., the compressor sucks in 1.15 c. b. m. air per minute through a fan and presses it into the air vessel. If the pressure in this vessel rise about 4.2 At. the suction pipes close automatically, and the compressor ceases work. As soon as the pressure in this vessel is down to 0.4 At., the connection is opened again, and the compressor forces new air into the vessel. The regulating apparatus connected to the compressor aids in keeping the cost energy within reasonable limits. Compressed air contains water vapors and oil, and these must be removed. In compressing air to 4.2 At., the air is warmed, and a part of the lubricating oil in the compressor cylinders evaporates and enters the air as it reaches the air vessel. To be able to separate the oil and the water vapor in the compressed air, the air vessel has a number of spiral pipes, through which cold water circulates. After cooling in upper portion of air vessel, the air passes into an oil separator in the lower part, where the condensed oil and water separate, and purified air passes into pipe lines. The air to be used for testing is further desiccated by being passed over calcium chloride, which draws out nearly all traces of moisture. The drying vessel contains five or more tiers of sieves with calcium chloride. The air enters the vessel, is pressed down in the space left between outer and inner mantle, rises and works upward through the calcium chloride sieves and passes out through a valve in the top cover.

The compressed air is used in cleaning walls, ceilings, and plain surfaces by suction, similar to the vacuum cleaning apparatus. In removing heavy layers of dust from switchboards, desks, etc., the simple air blast is used, and in cleaning cables, backs of switchboards, jacks, cords, etc., a combination of the suction process and blast are used. At various parts of rooms and halls are the standpipes with cocks to which lines of hose are connected. There is still room for improvement in this connection, especially in the line of avoiding and eliminating the whirling around of dust, which accompanies the use of compressed air blast.

The cleaning and examining of cables is, however, perfect, as far as can be done with the apparatus. All cables end in shafts and have a screw threaded hole cut into the lead pipe of the cables, which is closed air tight with a screw cap. If the cable is to be tested, the cap is removed, a threaded T-shaped union, containing a cock and manometer is substituted, and a line of hose for compressed air is screwed on to the other part of the T-shaped union. At the end of each cable the last soldered joint is also equipped with a screw thread and cap. At this place a manometer on a small foot is screwed on instead of the union. In testing, the compressed air is sent into the cable at its start, and if no great leaks are present, the manometer at the other end of the cable will gradually rise and show increase of pressure. The time needed for indication of passage of compressed air depends on the initial pressure of the air and the length of the cable, as also of the type of conductor covering. Cables, whose conductors are covered with a great deal of paper, offer greater resistance to compressed air than cables with little paper and wide air spaces. This difference is, however, without influence, provided the compressed air is dry. Experience has shown that a 2.5 km. long cable, with 250 double conductors, with a pressure of 0.5 At., needs 2½ hours to show results. Longer cables need a correspondingly longer time. In making tests, care must be taken to see that the joints where the union cock and manometer are attached are air tight. If this is done, one man controls the inflow of air at the inlet pipe and another man watches the manometer at the end of the pipe. If no pressure is shown after a reasonable length of time, there is indication of leakage. To find the leaks the linemen often bore holes into the lead cables at intervals of one km. or so and adjust manometers on these holes and read the indicator. Afterwards these holes can easily be plugged up again by special solder. After the larger leaks are closed up, examination is made of minor leaks and cracks. For this purpose the inlet cock at the beginning of the line which admits compressed air is closed, and the cable is left alone for several days with a definite amount of pressure within it. If, after a few days, the manometer at both ends read the proper known pressure, the air can be allowed to escape, manometers removed and screw caps adjusted again, as the cable has no leaks. If on the other hand the manometer pressure varies considerably at both ends, or drops, the proof of leaks or cracks is evident. In this case, compressed air is forced into the cables, and the manholes at various parts are opened and observation made as to the hissing and whistling sound heard as the air rushes out of the

cracks and leaks. If this is not a certain indicator, a lighted candle can be held along sections of cable and the place where the flame is blown away from the cable is evidence of a leak. Then the air is allowed to leave the cable, and after this the leak is closed by a special colophonium soldering tin, which gives good results. Another help of the compressed air system is in water entering conduits and injuring cables. In this case compressed air can be forced into the cables, and the pressure will force the water out of the cables and will keep it away from them till repairs can be made.

As an example in this connection we might tell about a case in which a 250-pair cable was filled with water, distant one km. from the exchange. This was dried by compressed air within 1½ days after discovery and after 50 hours was again repaired and ready for work. Another cable, where the water had not advanced quite so far, dried in 26 hours. These two mishaps were on a 140.7 m. long cable line. Had there not been the compressed air plant, the cables would have had to be exchanged for new ones, which would have been more expensive. Total cost of drying both cables was $37, whereas the exchange of cables would have cost $82, not counting the value of the new cable, $450.

The costs of this plant are $2,792.

a. Parts used for cable drying and dusting (motor, compressor, air vessel, water cooling coils, etc.)	$1,125
b. Parts for dust removal (618 m. pipe lines with 57 standpipe joints and cocks), with suction apparatus, filters, hose, etc.	825
c. Parts to test and dry cables (drying vessel with chemicals, pipe lines to conduits, manometers, etc.	842

The plant is used 3,000 hours per year, 6/10 for dusting, 4/10 for testing and drying of cables.

The operating expenses are:

a. For dusting, per year	$ 825
b. For cable testing	998
	$1,823

which is not a large sum when we remember the saving in trouble interruptions, the length of cables and the fact that the value of the exchange with cables is $2,000,000.—*Archiv für Post und Telegraphie.*

TELEPHONOGRAPHY.

Prof. Pierluigi recently made successful tests on Italian state lines with a new device which allows a phonograph to record telephone conversations, and thus gives an undoubtable proof of telephone statements.

The transmitting station has in the primary circuit of the induction coil a very sensitive microphone with carbon grains, through which a current from the battery flows. At the receiving station the listening telephone is connected with a megaphone. The telephonograph for recording conversations consists of a connection of a special telephone with the recording membrane of a Pathe phonograph. The mouth piece of the telephone is lengthened into a tube which is set into the end of the phonograph tube. The other end of the latter has a horizontal axis, around which a metal tube, fitting into the tube of the phonograph membrane revolves. A thin piece of rubber tubing connects these tubes. The iron diaphragm of the special telephone and the mica piece of the phonograph membrane are separated by a column of air enclosed on all sides. The sapphire point is firmly connected to a mica plate and presses upon the phonograph disc below it. The sliding tube fastened on the movable carriage of the phonograph eliminates the need of flexible connecting wires for the telephone.

In speaking through this telephone it is desirable to speak a little louder than usual so as to imprint a good record on the disc of the phonograph. If a person speaks through the mouth piece of the microphone and another person wishes to record the words, he moves a little lever to release the mechanism of the phonograph. While the receiving operator listens to the words through the receiver, the diaphragm of the special telephone transmits the vibrations of sound through the imprisoned air upon the phonograph membrane and the pointer inscribes the sound curve on the wax disc or roller. Then later on, a reproducing membrane and megaphone can be connected to the phonograph and the conversation can be reproduced, and serves as a permanent record.—*Elektrotechnischer Anzeiger.*

NEW TELEPHONE EXCHANGE IN KAIRO, EGYPT.

A Swedish telephone company recently installed a telephone exchange system in Kairo, Egypt, which is now open for service. It was first intended to use common battery system, but the fact that most of the wiring is overhead, and insulation due to climatic conditions is rather poor, resulted in installing a special combination of the magneto and common battery system. Calling the exchange is done by magneto inductors; the clearing signal is automatic as in common battery system.

The exchange has a long distance department for 22 long distance lines, and 10 alarm systems, one switchboard for 60 connecting wires from substations and 18 subscribers switchboards for 5,500 lines. The switchboard and multiple panels have a capacity of 12,000 subscribers. Every switchboard has three operators' places. Call and clearing signals are by 24 volt lamps, which are operated by relays set in mahogany boxes behind the switchboards. The storage battery current for the signal lamps is produced by two batteries of each 430 ampere capacity. These are charged by a transformer. The generators for the plant get current from electric light wires at 100 volts a. c., and a transformer changes this to d. c. 40 volts, 60 amperes. The plant, moreover, contains a rotary transformer, which is driven by current from the electric wires, and gives a. c. for calling subscribers. A marble switchboard with several panels contains all necessary switches, safety fuses, cut outs, etc.—*Elektroteknisk Tidsskrift.*

THE ECONOMIC QUESTION OF GERMAN AUTOMATIC TELEPHONES.

In looking over the report of the Bavarian government, in which state the automatic telephone has been tried extensively, we find that figures have been collected for 40,000 subscribers, distributed over seven exchanges. It has been supposed that with ten talks per day for every subscriber (12 per cent of these talks in business hours), we need two operators for every 100 subscribers, including supervision at a cost of $400 to which must be added 10 per cent for pensions and 12 per cent for depreciation, interest, etc. As regards the care and repairs in automatic exchanges, this

can be done by one mechanic and helper, for the instruments are now made of such excellent construction that repairs are rarely necessary. To the saving in this connection we have not added the elimination of recreation and lounging rooms, and all those details that must be looked after in any well regulated exchange where a large body of women operators is at work. The automatic system does away with this expense. The operating costs of manual systems have been set at $11 per five talks per day and subscriber, up to the limit of $34 per twenty talks. Add to this the cost of operating staff, and the greater cost of manual service is evident. The saving effected by the automatic telephone runs somewhat along these lines: With ten talks per day subscriber we have an annual saving of $7; with 15 talks, of $12; with twenty talks, of $18, etc. Taking the basis of 40,000 connections this would make the saving about $250,000. Comparisons of automatic systems of 10,000 and 20,000 lines show that systems below the 10,000 limit are not as economical as the larger limits, and the smaller ones do not show such a great difference in cost from the manual system. Above this limit the saving increases, for we must assume that an exchange with such a number of subscribers' lines would be split up into two exchanges which entails additional expense for equipment and operators.

The semi-automatic system, according to the report, is not as economical as the automatic system. This is due, first of all, to the relative novelty of the service which does not permit the operators to make as many connections per hour as they would with the old well-known type of manual service. The saving in cost over the manual system, in which an operator can make 250 to 1,000 connections per hour as against 450 at most by the semi-automatic service, is only about $5, which is $2 less than the automatic service. A great saving common to both systems is the fact that fewer cables and conduits are needed, for instead of one larger exchange within a radius of several miles we can have seven or eight of them, which reduces the length of cables used to connect subscribers' wires to the telephone exchange, consequently reduces installation costs. If we take the average length of cable per subscriber to be about 6 to 10 km the increase of the number of exchanges will reduce this number to 2 km and will at the same time increase the available connections to 50,000 or more. The construction of exchanges is also much less expensive in the automatic service, for no special buildings are needed for this service, whereas the manual system required specially constructed buildings. Of course, it is out of the question to do away with the manual system and substitute the automatic system, for the enormous values of present telephone equipment in the various exchanges would simply be wasted, which would more than outbalance the economy in operation. But where new exchanges are contemplated, the automatic or semi-automatic systems can be installed, thereby reducing operating expenses and modernizing telephone service.

The automatic service has made remarkable progress since its perfection some years ago, and as usual, America leads the van. In Europe we have Bavaria, Austria, Holland and many cities of Germany with automatic service, and Munich in Bavaria has recently placed in service an automatic telephone system with over 30,000 subscribers lines.—*Elektrotechnische Zeitschrift.*

A. T. & T. to Issue Stock for $50,000,000

Directors of American Telephone and Telegraph have voted to authorize the issuance of approximately $50,000,000 stock in ratio of one share of new stock for each five shares held. Rights attach as of June 1 and expire August 31. The stock is offered at par.

The first payment on account of the new issue will be made November 1, 1911, and will be for 25 per cent. The balance will be paid for in three equal instalments of 25 per cent each, payable February 1, 1912, May 1, 1912, and August 1, 1912. This gives shareholders fourteen months in which to pay for their stock. Partially paid stock will earn interest at current dividend rate, which will be paid on the same day as the regular dividends are distributed. Prepayment in full may be made, but only 4 per cent interest in this case will be allowed. The company has issued the following statement:

The proceeds of this issue of capital stock will be mainly used to provide the associated companies of the Bell system outside of the state of New York with funds for current and ordinary construction and extension of plant, and will be represented in the treasury of the American Telephone & Telegraph Company by the share capital or the capital advance notes of such companies.

A part will be used for extensions to plant (long distance service) of the American Telephone & Telegraph Company outside the state of New York; and a part to maintain the cash balances now being drawn upon for all the above purposes.

White Cedar Report

H. H. McKinney, secretary of the Northwestern Cedarmen's Association, Minneapolis, Minn., has made a report showing the conditions which govern the present supply of white cedar products and a forecast of the conditions for the remainder of 1911. Mr. McKinney states that the present supply of seasoned stock of all lengths of poles and posts is unusually low, with a steadily increasing demand for stock and a much smaller source of supply than a year ago. The increase in consumption of 10 per cent in 1911 over that of 1910 will practically wipe out stocks of all sizes from 7-foot posts up before another logging season is finished. As shown by statistics there were about 875,000 more poles from 16 feet in length up January 1, 1910, than at the same date of this year and the production for the past winter was 20 per cent below the estimate. The estimated consumption of white cedar poles from 16 feet up for the present year is 2,452,187.

Altitude Record for Telephone Stations

The meteorological station on the summit of Mount Rosa in the Italian Alps claims the distinction of being the highest telephone station in existence, being 14,960 feet above sea level. The installation of this station was considered a wonderful feat as it is in the region of perpetual snow. Poles could not be used, and the wire was laid along the ground. The snow being very dry is almost a non-conductor and in order to obtain a good ground for the wire the director had himself lowered by ropes into the deep crevice of a glacier, the only place suitable. The observatory is of wood, having double walls four inches apart, and is covered with copper.

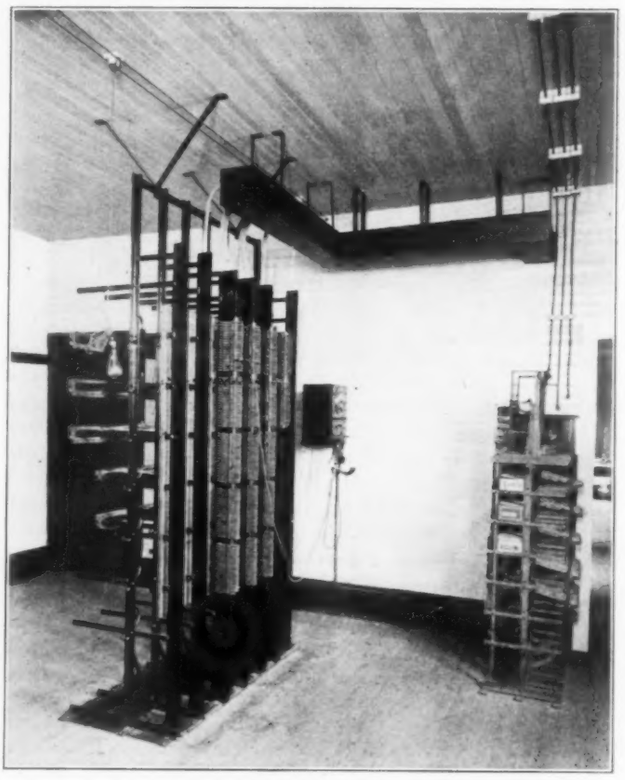
Exchange Equipment at Tupelo, Mississippi

By Charles F. Morris

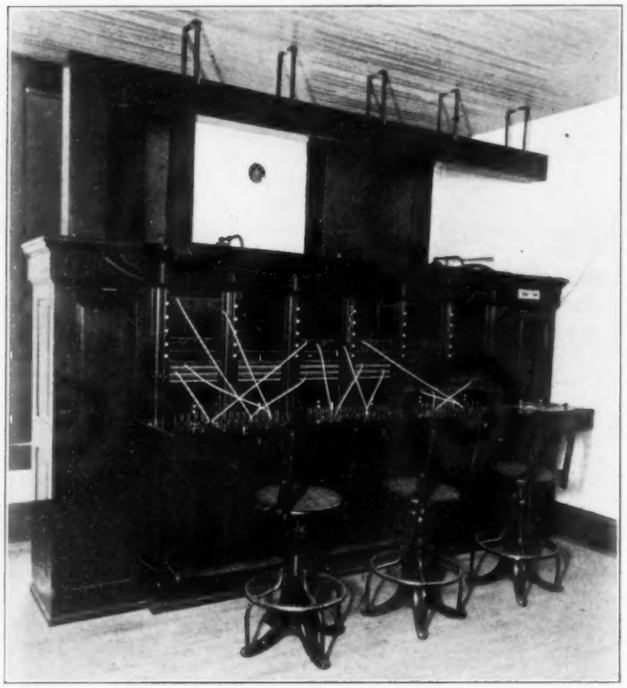
THE new exchange of the Stantonville Telephone Company at Tupelo, Miss., has been designed with the object of efficiency constantly in view. The Tupelo switchboard is relatively small, but the newest and best in telephony is embodied in the equipment which has recently been installed at that point. Two sections of common battery, lamp signal board designed for two operator' positions are handling the subscribers' traffic. One combination toll and rural position has been equipped with combined jacks and signals of the newest type to accommodate magneto calls from the rural districts and to handle the toll traffic. There is also a cable turning section and a removable panel at the other end of the switchboard.

The switchboard is so arranged that additions to the existing equipment may be installed at any time to bring the exchange up to its ultimate capacity of 1,600 lines. At present there are 380 subscribers' lines, twenty rural and ten toll lines. The board is equipped with fifteen cord circuits for each subscribers' operators' position, three operator's telephone circuits, two telephone transfer circuits, six auxiliary signal circuits, a night alarm circuit, lighting circuit and calculagraph.

As usual with this type of equipment, the switchboard is constructed of selected birch lumber, with mahogany face and key shelves. The sections are carefully designed and rigidly constructed to prevent any warping or cracking. The operators' keys are mounted on substantial iron mounting strips, with machine screws, which permit their removal without difficulty and without marring the woodwork. The plug shelves are covered with leather set flush with the woodwork and finished to match. This is to protect them from injury through the falling of the plugs.



Tupelo Terminal Room.



Operating Room at Tupelo.

The cable turning section is of sufficient size to accommodate the ultimate cables from the switchboards to the other parts of the equipment. The front and outside is paneled and finished the same as the woodwork of the sections. The moulding which extends along the face of the switchboard is brought across the face and around the end of this turning section. A removable door is provided to allow ready access to the cable.

The combined jacks and signals for the toll and rural line circuits are of the self-restoring type. When the signal is in its normal unoperated position, it presents a dead black finish to the operator. When operated a red surface is displayed.

Cable and cable support have been provided with the exchange, the support consisting of a birch box stained to match the woodwork of the switchboard frame.

A floor-type main distributing frame is provided with an equipment of 400 lines on the cable and iron work for 480 lines. The vertical side consists of three bars of arresters equipped with heat coils, carbons and micas for the common battery, toll and rural lines terminating in the switchboard.

An interesting portion of the equipment is the testing cabinet of the No. 1407 type, which, as is

shown in the illustration, has been placed conveniently close to the main distributing frame. This small apparatus takes the place of a wire chief's desk for an equipment of this size, and it performs all the tests that a wire chief's desk is usually called upon to perform. The apparatus consists of a testing circuit, an operator's circuit, a ringing circuit with keys and a grounding cord, with flexible cord and plug. With these cords it is possible at any time to establish connections with the lines terminating in the switchboard.

The power plant is designed to operate from a 110-volt direct current source of power. It consists of eleven cells of storage battery and a power board, together with the power fire and insulators. The battery when fully charged will carry the present equipment for four days before re-charging, assuming a calling rate of ten calls per line per day. The power board contains an ammeter and voltmeter and is equipped with the sockets and lamps for charging from direct

Batteries and Power Board.

current, together with the fuses and switches for proper handling of the current.

The officials of the Stantonville Telephone Company have reason to be proud of the standard they have established in the equipment of their new exchange.

Telephone and Telegraph Systems in China

Consul General Samuel S. Knabenshue, Tientsin, China, says that on January 1, 1909, there were in Tientsin 1,304 telephone connections, of which 53 were extension or private lines, 4,046 miles of cable wire and 1,853 miles of open wire. After that date the telephone administration adopted the Chinese calendar, and the following official returns are furnished: End of twelfth moon, first year of Hsuan Tung (February 13, 1910), 1,518 subscribers, of which 70 were extension or private lines, 4,468 miles of cable wire and 2,016 miles of open wire. End of tenth moon, second year of Hsuan Tung (December 1, 1910), 1,777 subscribers, of which 127 were extension or private lines. The wire mileage is not made up until the end of the Chinese year.

The engineer in charge of the Peking Telephone Administration furnishes the following figures and says: "The statistics of our exchange are kept according to the Chinese calendar, and the figures for the present Chinese year (1910) are in round numbers, as the extension works are not yet completed:

Year.	Subscribers connected to office.	Subscribers waiting for connection.	Mileage of wires.
1908	1,563	784	5,198
1909	1,608	970	5,353
1910	1,623	1,251	12,819

The engineer further says: "From 1907 we stopped connecting subscribers, as our switchboard capacity was not sufficient, unless we should entirely change the switching system. In the summer of 1910 we commenced extension of the telephone work, installing common battery multiple switchboards and laying underground cables. This work is still going on."

I am able to give, from other but absolutely reliable sources, some facts concerning the new telephone installation, now in progress in Peking, which will cover both the Tartar and the Chinese city. The work is being done directly by the Imperial Chinese Telephone Administration, with the assistance of two specialists sent out for this work by the Western Electric Company of New York and London, which furnishes the machinery and apparatus. It is expected that the installation will be completed and ready for use by May, 1911. The system is known as the common battery signalling system, which has been in operation in the United States for more than twelve years.

Two telephone exchange buildings have been erected. The first is a large foreign edifice, of red brick, on the Hatamen road, and the second is in the Chinese city, close to the Tartar city wall. Three thousand telephones are being put up, but the plant will admit of an increase to 12,000, as the switchboards at each of the two exchanges have a capacity of 6,000 telephones. The telephone wires have been laid underground. This, although it has increased the initial outlay, will greatly reduce the subsequent cost of maintenance, as no damages to poles or wires, caused by gales, etc., will have to be reckoned with.

The cables are of lead tubing, 3½ inches in diameter, and contain 400 wires. The wires are wrapped loosely in paper, the function of the paper being merely to hold the wires apart. The cables are laid in earthenware pipes.

All the foreign subscribers' numbers will be assembled on one section of the switchboard, which will be in charge of operators who understand English. This will save a great deal of time and worry.

Animal Foes of Telephone Lines

The animal world has placed some heavy difficulties in the way of extending the telegraph, says a writer in *Zeitschrift für Post und Telegraphie*, and is, even today, the cause of disturbances. An obstinate enemy of the telegraph was the elephant. A French weekly journal, which devoted an article to these animals in this connection, related how the mighty pachyderms repeatedly tore the telegraph poles out of the earth with their trunks and caused general destruction. But almost worse were the disturbances caused to the first lines in India by the buffalo. With lowered, threatening head he charged against the poles, and those which did not yield to the first assault succumbed to the second, and mighty was the fall thereof.

In America the cave-dwelling animals have occasioned engineers and electricians many troubles. The armadillo, the hare and the skunk chose the telegraph poles for their burrowings, delved their subterranean passages and in course of time brought about the fall of the poles. The bears in Norway were at feud with the telegraph; the humming of the wires led them to believe that the poles were the headquarters of bees, and they pursued that enticing goal. Their longing for honey gave rise to fresh destruction. But the shaggy dwellers in the forest learned by their disappointment; the number of attacks on telegraph lines decreased more and more, and eventually the humming of the wires lost its attractive power.

In Africa and Asia telegraphic wires formed an acceptable gymnastic apparatus for the apes; consequently the wires became broken and deranged, and the routes had to be continually visited to make good the sins of the apes. Most useful of all, however, has this invention of man been to the birds. They find the wires a convenient resting place. The woodpecker hammered deep holes in the wood; but in time he also learned the fruitlessness of his labors and gave them up. In America hundreds of poles had to be replaced because the woodpecker had so pierced them that they fell victims to the first storm.

Among insects the birth of telegraphy was apparently hailed with joy. Wild bees chose the insulators for their nests, covered the glass with dust to prevent the sun's rays from burning through, and then built their nests. Spiders show a special preference for telegraph wires, and often cover the wires with their webs for long distances. In Japan these webs attain such proportions that they deflect the current and hinder the messages. Special officers therefore go over appointed sections to clear away the webs.

In the depths of the ocean there is the teredo, which penetrates the cable and in the gutta-percha covering finds a change from the monotony of wood nourishment. The sawfish causes bad disturbances when he sometimes encounters the cable. The hindrance so annoys him that he attacks the cable with his saw and disturbs the line. The submarine cables do not always follow the bottom of the sea, but often stretch from one submarine hilltop to another. This the whales utilize as a convenient means of disembarrassing themselves of their troublesome parasites and rub against the cables until mussels, algæ and snails are rubbed off. But these submarine toilets have dangers both for the whale and the cable. Sometimes the tail of the former is enfolded in the cable and he cannot free himself. His lot is then suffocation. In July, 1873, during works of repair, several such whales were found which had been caught in the cables as in a sling, and a similar phenomenon was observed in October, 1899, on the Brazilian coast. The cable ship *Viking* tested the cable, and eventually cut it through at the place where the current was arrested. Great was the astonishment when immediately thereupon, as if impelled by some mighty power, the body of a monstrous whale came to the surface of the water.

The Cuyahoga Telephone Company, of Cleveland, which has heretofore set aside 23¼ per cent of its gross receipts for a depreciation and maintenance fund, will increase the allowance to 30 per cent, as the company wishes to make ample provision for these items of expenditure.

Alloys for Permanent Magnets

Investigations of electrolytic iron and its alloys have been carried out by C. F. Burgess and J. Ashton, and are described in the *Metallurgical and Chemical Engineer*. Tests were made of the magnetic quality of all the samples. Among these were many which showed low permeabilities and high coercive force, suggesting their utility for permanent magnets rather than as electro-magnetic material. Upward of 100 samples were tested for this feature; all of the bars contained Cr, Mn, Mo, Ni, and W as binary alloys or in various combinations together or with other elements. The tests recorded in the paper are for the most part on carbon-free alloys. The results are mainly of value, therefore, as indicating the influence of the various elements in inducing the conditions necessary for a good permanent magnet. They were carried out on an Esterline permeameter. The bars were tested as forged, and after water quenching at 1,000 deg. C. To prevent oxidation of the samples while heating them for quenching a barium chloride bath was used. The quenching at 1,000 deg. C. will probably not have brought out the best qualities of some of the bars, but it was deemed the best general treatment, since with so many bars under test it was impossible to subject each sample to tests for its critical points and special conditions of heating. In addition to these general tests, all bars which showed a fair retentivity and a coercive force about 30 were subjected to a test of their ability to hold residual magnetism after shock. For this test the bar was subjected to the maximum magnetizing force of 200 C. G. S. units, and the retentivity noted when this magnetizing force was reduced to zero. The bar was then removed from the machine, subjected to the disturbing factor, and the retentivity again recorded after reinserting the specimen in the permeameter. Two means commonly employed in practice for seasoning permanent magnets were used, viz., jarring or rapping the bar and boiling. For the latter treatment each bar was inserted in a piece of wrought iron pipe, which served as a shield to prevent the mutual influence of the magnetic fields, and boiled in water for three hours. A large number of trials of the rapping and boiling treatments showed them to be practically equal in their effect. An extensive series of tables is given in the paper, which set forth the main results of the investigations. From the figures it is deduced that Cr, Mn, Mo, and W are the most important elements for use in the manufacture of permanent magnets. The presence of a third element is necessary. While carbon is beneficial, it is possible to obtain highly satisfactory materials either by various combinations of the four above mentioned elements or by suitable additions of Si or V, the latter, in particular, being very suitable. When the material for the permanent magnet is to be hardened by quenching, the presence of a considerable amount of carbon is desirable.

New Hampshire Commissioners Appointed

Governor Bass of New Hampshire has nominated the following as members of the Public Service Commission of that state and the same have been confirmed by the council: Edward C. Niles, Concord; John E. Benton of Keene, and Prof. Thomas W. D. Worthen of Hanover. Messrs. Benton and Niles are prominent lawyers and Professor Worthen is head of the department of mathematics at Dartmouth College.

The Law and the Telephone

By E. J. Wenner

WICHITA, KANSAS, OFFERS SCORED BY COURT—RATE ORDINANCE LITIGATION.

THE Federal court sitting in Kansas City, enjoined the officers of Wichita, Kan., from enforcing a recent ordinance passed by the mayor and commissioners regulating telephone rates.

The telephone company says that it was losing money and that it raised its rates last September. Immediately after the rise in rates the mayor and commissioners interfered and secured the consent of the company to suspend the rates until the city could investigate. The city hired bonded accountants to investigate the books of the telephone company and report to the city.

The accountants reported that they had made a thorough examination and that the company was losing money at the rate of $37,000 per year, and that on the new and proposed rates the company would earn only $7,000 a year. The accountants also reported that about one million dollars had been invested by the company in the Wichita telephone property.

Other accountants were employed by the city and their reports were very similar.

The city declined to furnish the court with the reports which it admitted it had. It was shown that the ordinance, which forced on the telephone company a loss of $37,000 a year, provided such penalties that if the company violated the ordinance for one month the fines under it would amount to $900,000, and somebody would have to stay in jail 2,250 years.

The court in rendering the decision said to the city officials who were present:

"If this were a banking company it would move out of your city, and I would advise it to do so, but being a telephone company it cannot move. It is impossible for me to see how the city can object to an injunction in this case; in doing so they ask the court to confiscate the property of the telephone company. The telephone is a useful and necessary thing. To require the telephone company to bestow upon the citizens of Wichita service at less than cost is, of course, confiscation.

"Counsel for the city avers without proof, that the service is not good. I do not see how the city can expect good service if it refuses to pay for it. It is shown here that even at the new rates the telephone company will earn only $7,000 a year on property certainly worth $600,000 or $800,000. If I had money to invest I certainly would not invest it in telephone property, or any other public utility. The enforcement of the ordinance is enjoined until the final hearing."

SECOND TRIAL RESULTS IN A TEN THOUSAND DOLLAR VERDICT—PLAINTIFF GIVEN FULL AMOUNT.

About a year ago M. J. Aaron of Lansing, Kan., brought suit in the District Court against the Missouri and Kansas Telephone Company for $10,000 damages on account of the death of plaintiff's son, Walter, who, while employed by Delaware Mutual Telephone Company, was killed by a falling pole. The court gave the plaintiff a judgment for $10,000, but upon appeal to the Supreme Court a new trial was ordered on account of an error in the instructions to the jury given by the trial judge.

In the second trial the Delaware Mutual Telephone Company was not made a party on account of the suit having been dismissed against it, and only the Missouri and Kansas Telephone Company was defendant.

The second trial lasted five days, and of this time four days were taken by the plaintiff for the introduction of evidence. The defendant introduced no evidence and rested its case at the close of plaintiff's testimony.

The jury deliberated for four hours and returned a verdict for $10,000 for the plaintiff.

CASE INVOLVING NECESSITY OF FRANCHISE UP AGAIN.

The case of East Boyer Telephone Company vs. the incorporated town of Vail, decided by the Supreme Court of Iowa some few months ago, will be reconsidered by the court. The court decided that it was not necessary that a telephone company secure permission from the authorities of the town of Vail or from the inhabitants of the town before establishing an exchange and erecting poles, wires, etc., within its corporate limits. The telephone company has petitioned the Supreme Court for a rehearing, laying particular stress upon the claim that the court failed to give proper consideration to the provision of the law requiring telephone companies to secure a franchise before establishing an exchange within a town. A rehearing has been granted and it will be interesting to know whether the court will change its former decision.

This is a question of the utmost importance to telephone companies and if the court eventually finds that it is necessary to secure a franchise it will satisfy the majority of the residents of incorporated towns or cities. However, the Iowa statutes are somewhat peculiar, and it will be rembered that this decision was based largely upon the interpretation of them.

OBSTRUCTION OF TELEPHONE SERVICE ENJOINED.

In the courts at Clinton, Mo., the Missouri Union Telephone Company was given a permanent injunction against W. W. Adamson, enjoining Adamson from doing particular acts on the ground that said acts were an obstruction of the service of plaintiff to its subscribers, for which it had no adequate remedy at law. The court specifically stated that if the defendant had a contractual right it could hereafter be determined by an independent action by the defendant.

DAMAGES ALLOWED BECAUSE OF CONTACT WITH LIVE WIRE.

We frequently hear of damages claimed by persons who were injured on account of coming into contact with a wire belonging to a telephone company, which wire had in some manner become crossed with a high power wire. In the present case in Atlanta, Ga., J. B. Muldrow a lineman in the employ of the Southern Bell Telephone and Telegraph Company, brought suit against this company and the Georgia Railway

and Electric Company claiming damages on account of a serious burn received when he touched a telephone wire which had been allowed to sag. It appears the sag was caused by negligence on the part of the telephone company and that the wire had come in contact with a high power cable belonging to the electric company. The plaintiff asked for damages in the amount of $10,000 and was awarded a verdict for $2,500.

PLAINTIFF UNSUCCESSFUL IN SUIT FOR DAMAGES ON ACCOUNT OF LIVE WIRE.

In the case of Luckinbill vs. Central Union Telephone Company tried at Bloomington, Ill., a verdict was returned in favor of the defendant. A motion for a new trial has been denied.

The plaintiff is a patrolman in the employ of the city, and he claims to have been injured by the handling of a live wire while performing his official duties. He claimed the defendant guilty of negligence on account of the position of the wire, but the court found against him in his contention.

TELEPHONE COMPANY ASKED FOR BACK TAXES.

Suit was brought in the Superior Court at San Francisco by the City and County of San Francisco against the Pacific Telephone and Telegraph Company for the recovery of $502 of taxes claimed to be owing by the defendant.

The claim is based upon an ordinance passed by the board of supervisors in 1903, requiring all telephone companies having an income of more than $500,000 a year to pay a tax of $251 per quarter.

The claim of the attorney for the plaintiff is that the books and records of the defendant show receipts in excess of $500,000 a year. Demand has been made upon the defendant for the tax and its payment has been refused.

SUIT FOR POLE TAX FIXED BY ORDINANCE.

The City of St. Joseph, Mo., has brought suit against the Home Telephone Company to recover a tax fixed by ordinance. The ordinance provides that the telephone company shall pay tax of a certain amount upon each wooden telephone pole within the city limits. The city has demanded this tax and the company has refused to pay it.

The company claims that under its franchise the city has the right to use the upper arms of all of the company's wooden poles for electric light wires or for police and fire alarm signals, and on account of this right, which it has used, the city cannot legally require the company to pay the tax.

DAMAGES ASKED FOR FAILURE TO INSTALL TELEPHONE.

Dominick Perotti has brought suit in the courts of Memphis, Tenn., against the Memphis Telephone Company claiming damages from the defendant in the sum of $4,400 on account of its refusal to install a telephone in his place of business.

The plaintiff claims to have paid the company to place a telephone on April 5. He states they have failed to do this and claims damages of $100 for each day after the first ten days.

Within the last few years it seems a great many suits have been filed by parties who have not been given telephone service for which they contracted. Heretofore but few suits were filed on this account and these most recent actions are somewhat novel.

WESTERN UNION TELEGRAPH COMPANY GIVEN RIGHT TO APPEAL.

In an action pending in the United States Court in Boston, permission was given the Western Union Telegraph Company to appeal to the United States Circuit Court of Appeals. This action was brought several years ago by this company against three other companies, one of which is the American Bell Telephone Company, and arises on account of infringement of patents. The plaintiff has been awarded damages in the amount of $3,141,529 and certain shares of capital stock. It claims much more than has been allowed and is appealing on that account.

TELEPHONE COMPANY UNSUCCESSFUL.

Some time ago Frank P. Dearing brought an action against the Independent Union Telephone Company of Buffalo, New York, and secured a judgment for damages for failure on the part of the company to transmit a telephone message.

Recently the attorney for the company petitioned for permission to re-argue the case on the theory that the court had not followed the law and the evidence in the trial. This petition has been denied and early in the present month papers were filed in the proper court showing the dismissal of the re-argument and the closing of the case.

TEST CASE IN KANSAS—PUBLIC UTILITIES LAW TO BE TRIED OUT.

The laws of Kansas provide that the public utilities commission has authority to order the different telephone companies to connect one with another for the accommodation of their subscribers. The Girard Mutual Telephone Company has an exchange in the town of Girard, but has no long distance lines and makes no connections with long distance lines, though the Bell Company and another independent company have long distance lines running into, and an exchange in Girard. The Mutual Company wants to have connection with one or the other of the long distance lines and has asked the commission for an order requiring one or the other of the companies to make connections with it.

The defendant companies contend that the utilities commission has no authority to order such a connection in view of the fact that the utilities laws specifically provides that it shall not apply to mutual companies not operated for profit. They claim the Girard Company is such a mutual company. It is expected the commission will issue the order asked and that the other companies will refuse to regard it and the matter will be taken to the courts for a final settlement. The members of the commission are particularly anxious that the new law be tested in the courts in order that they may know their powers.

TELEPHONE COMPANY SUES COUNTY TO RECOVER RATES.

The Northwestern Telephone Company of Grand Forks, N. D., has brought suit against the County for $2,028. This amount is claimed for telephone rent due from the county for telephone service furnished to the county offices for a period of six years.

The county commissioners claim that the telephone company was ordered to remove its instruments from the court house, and were finally told that they might leave them for the tolls that they might bring

the company. The county claims that this arrangement was satisfactory to the company and that the county had the use of the instruments free of charge.

LARGE DAMAGES ASKED FOR REFUSAL TO FURNISH SERVICE.

W. C. Younts, of Fourche Dam, Ark., has brought suit against the Southwestern Telephone and Telegraph Company for $38,500.

This suit is brought under the provisions of the law of Arkansas which provides a penalty of $100 for each day of discrimination. Plaintiff claims to have been discriminated against by the defendant and states that he applied for telephone connections which were refused, while at the same time his neighbors and others were given connection. He claims to have applied on many different occasions and that his applications complied with all of the conditions required of other subscribers similarily situated. He alleged that his applcations were made both verbally and in writing and that in each instance the application was ignored.

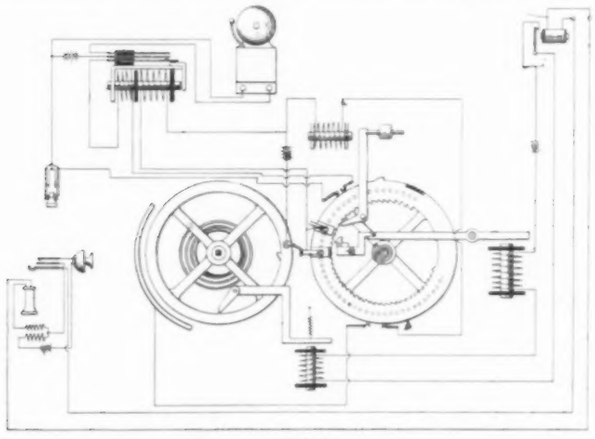
Recent Telephone Patents

By David S. Hulfish

969,985. Signaling System. Harry O. Rugh, assignor to Sandwich Electric Company, Sandwich, Ill. A signaling system adapted for use in train dispatching, providing for a telephone line reaching several switching points and selecting from one end by means of stepping devices at the various stations. The feature of the invention is to provide a circuit workable over certain faults, auxiliary working circuits being available over the line wires in case the main circuit becomes defective.

973,808. Signaling System. Emory Parsons, Chicago, Ill. A line with several stations is shown; series magnets are included in the line conductor, and stepping devices at all stations may be controlled from any station to operate a signal bell.

976,380. Signaling System. Oscar M. Leich, Genoa, Ill., assignor to Cracraft, Leich Electric Company, of same place. The invention is particularly for railroad telephone systems. The invention comprises a stepping element driven over the line in combination with a clock driven element moving more slowly.



976,380.

When the line-driven element stops and the clock-driven element catches up with it, the signal is rung. Simplification of the signaling currents of the line is attained.

977,657. Telephone Transmission System. Otto T. Lademan, Milwaukee, Wis. The station telephones are bridged across the line conductors, and means is given at each station for varying the impedance of the telephone bridge; by this means the stations may be balanced to receive speech equally from the dispatcher's office regardless of distance.

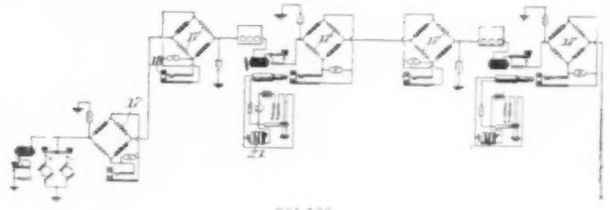
978,909. Composite Telephone and Telegraph System. Oscar M. Leich, Genoa, Ill., assignor to Cracraft, Leich Electric Company, of same place. The system has a line wire forming the circuit for telegraph relays and telegraph keys; telephone instruments are connected in multiple with the relay coils and in series in the circuit, while the telegraph keys have condensers in shunt of them to provide a circuit for speech currents.

979,676. Switching System for Railroad Telephone Lines. Otto T. Lademan, Milwaukee, Wis. An arrangement of switches and circuits for convenience in using a single telephone set in connecting with several telephone lines, and for connecting the lines and signals in specific ways.

U. S. Patent No. 980,921. Loaded Phantom Circuit. G. A. Campbell, Brooklyn, N. Y., and Thomas Shaw, Hackensack, N. J., assignors to American Telephone and Telegraph Company, New York, N. Y. A phantom circuit is built of two metallic circuits, four wires in all. In addition to loading coils or inductances in the metallic circuits separately, the inventors provide additional inductances for the phantom circuit in which the four wires all are included in turns about a single core.

981,015.—Loading for Phantom Conductors. Thomas Shaw, Hackensack, N. J., assignor to American Telephone and Telegraph Company, New York, N. Y. An arrangement of structural details of loading coil for a metallic circuit such that a minimum of interference will be experienced when using the loaded metallic circuit as one conductor of a phantom. This coil does not properly load the phantom circuit, but loads the metallic circuit without interfering with its use for the phantom.

981,120. Composite. R. O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, of same place. The drawing shows the well known Dean parallelogram of balanced ohms and unbalanced henries, 17 in the illustration, cut serially into



981,120.

the line conductor of a composited line, the telephone instruments within the parallelogram then being unresponsive to the telegraph currents of the line.

981,399. Semi-Automatic Trunking System. A. H. Dyson, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place. Automatic devices are provided for extending a calling line to a telephone operator, but these automatic distributing devices are themselves under control of a distributing operator.

982,209. Bridging Telephone System. Henry F. Joeckel, Camp Point, Ill. The combination of the metallic line circuit, magneto call, bridging telephone set and local battery, with an additional line wire constituting a grounded signaling circuit insulated from the metallic talking circuit.

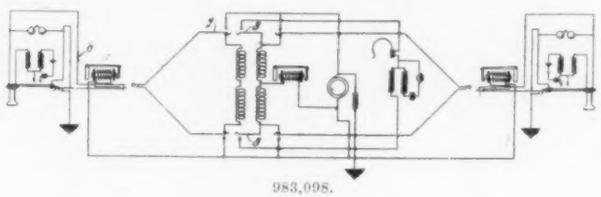
982,213. Intercommunicating Switch. S. A. Koltonski, Boston, Mass., assignor to Electromechanical Works, of same place. The depression of any button of the switch connects the calling telephone with the line desired, and hanging up the receiver releases the switch. By an ingenious arrangement of mechanical parts, the framework of the switch may be separated for inspection, adjustment and repair of the parts.

982,450. Desk Telephone. Samuel L. Van Akin, Jr., Liverpool, N. Y. Receiver and transmitter are united in microtelephone style and are attached to a tubular hinged arm that they may be brought to a desired position for use. Conductors pass through the arm.

982,546. Lock-Out System. Albert Swenson, Willmar, Minn. In a line with selective signaling, the exchange operator locks out all stations, then locks in the station rung.

982,641. Mouthpiece. Louis Steinberger, New York, N. Y. A flange and clamp ring are provided for holding an annular card for directory, instruction or advertising at the larger end of the funnel.

983,098. Telephone Switchboard System. Frank C. Unger, St. Louis, Mo. Calling and clearing is effected by substation transient grounds in connection with the central office ringing



983,098.

generator. As the ringing generator is connected to all lines at all times, whether connected or idle, the system requires well balanced metallic lines.

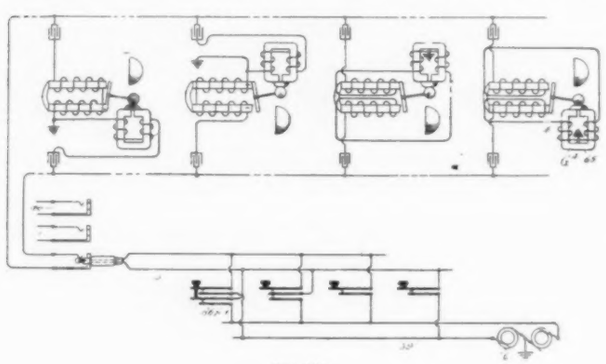
983,491. Mouthpiece. G. T. Hadley, San Francisco, Cal. A globular resonator is attached to the front of the transmitter mouthpiece; it is perforated for collection of sound, and acts as a sanitary attachment.

983,570. Receiver Holder. S. K. Rothschild, Detroit, Mich. A case for a telephone receiver within which the receiver turns freely.

983,899. Selector. R. R. Hobbs, Louisville, Ky. A ratchet stepping device for use in connection with stepping selecting systems for ringing upon party lines.

983,966. Telephone Testing System. C. S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place. Current from the busy line charges an inductance, the discharge of which is audible to the operator's receiver.

984,202 and 984,203. Selective Signaling System. John Erickson, Chicago, Ill., assignor to First Trust and Savings Bank, trustee, of same place. Each station of a four-party line



984,202.

has magnets for ringing the gongs and a magnet to prevent ringing. By proper co-operation, only the one desired station is rung.

984,204. Lockout for Automatic Party-Line Telephone. John Erickson, Chicago, Ill., assignor to First Trust and Savings Bank, trustee, of same place. In a Strowger type telephone, the hook switch cannot send the releasing impulse unless an auxiliary magnet is energized.

984,235. Announcing System. Arpad Nemeth, New York, N. Y., assignor to United States Telephone Herald Company, Wilmington, Del. Announcements made by central office transmitters are carried to substation receivers in series, that service to all receivers may be uniform.

984,547. Switchboard System. F. W. Dunbar, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place. This patent is issued upon an old application, filed in 1901, and appears to cover broadly the Kellogg arrangement of cut-off relay whereby the current for effacement of the ine signal is carried in part over a talking conductor.

984,558. Mouthpiece. John Graham, Philadelphia, Pa. A detachable paper cone, for antiseptic purposes.

984,679. Attachment. S. O. Lancaster, London, Canada. A holder for telephone receivers, attachable to desk stands, and acting also to operate the hook lever without removing the receiver from the holder.

984,686. Intercommunicating System. Ray H. Manson, Elyria, Ohio, assignor to Dean Electric Company, of same place. The patent is for circuits pertaining to holding the signals at a main common battery switchboard to which the intercommunicating system is subsiliary.

984,738. Anti-Induction System. A. Barrett and W. Conden, Kansas City, Mo. A telephone line is balanced against inductive disturbances by inclusion in branch circuits of adjustable inductive elements at the substations.

984,945. Party Line. O. M. Leich, Genoa, Il., assignor to Cracraft-Leich Electric Company of same place. Each telephone set is provided with a switch whereby it may be taken from the metallic line and connected between earth and the phantom conductor.

984,958. Trunk. J. G. Mitchell, Cleveland, Ohio, assignor to North Electric Company, of same place. A specific arrangement of parts in a trunk circuit between two common battery switchboards. Three-way cords with cut-off jacks are shown in the drawings of the patent.

985,021. Attachment. W. M. English, Sausalito, Cal., Louis E. Boukofsky, San Francisco, Cal., and S. M. Lichtenstein, San Francisco, Cal. A metal ring is included between the funnel and the case, and is adapted to hold an absorbent material for an antiseptic.

Chicago Men Said To Want Gotham Franchise

J. Ogden Armour and other Chicago interests are reported to be back of a scheme to establish an independent automatic telephone system in Greater New York. Several efforts to obtain a franchise have been defeated by the board of estimate, but the latest scheme is to secure an old franchise. This franchise is the property of the American District Telegraph Company of Brooklyn, the oldest and about the only remaining independent company of its kind in the United States. It is stated that the officers of the company, acting for western interests believed to be associated with the backers and promoters of the new automatic telephone company which recently began business in Chicago, have already obtained four-fifths of the stock of the American District Telegraph Company of Brooklyn on options which do not expire until October of this year.

Telephone Statistics for Italy

Since the installation of telephones in Italy 60,792,186 lire have been voted for the service, all of which has been spent except 9,200,215 lire. The estimated expenditure for new telephones for the year 1910-1911 is fixed at 5,260,000 lire. Statistics show that in 1910 the state system had 377 exchanges, with 46,293 subscribers, and the exchanges of private companies numbered 671, with 20,170 subscribers. The interurban lines of the state system had an extension of 22,838 km., private interurban lines 3,704 km., and international lines 739 km. During this time the interurban calls on the state system were 2,880,358 and those of private companies 1,511,252. The international calls were with the following countries: France, 97,469; Switzerland, 72,884; Austria, 2,833. The small number of calls of Austria compared with the other countries is due to the fact that the system had only been in operation two months and a half.

DEPARTMENT of RAILWAY TELEPHONES

The Railway Wire Chief

By John A. Kick

A SUCCESSFUL railway wire chief must have a general knowledge of the electrical features of his plant (circuit and apparatus); the physical makeup and condition; the sequence of circuit preference and a sufficient knowledge of railway operation to enable him correctly to judge the relative importance of the several classes of telegrams, reports, etc. He must be able to effect and maintain an organization each member of which is so concerned in the good record of the office as to display a certain amount of personal interest in the standing maintained in the "Relay office comparative records."

In commenting on the ability of wire chiefs much stress is often placed on the fact that this or that man "never becomes excited," "takes everything coolly," and "never worries." To a degree this is a qualification, but not necessarily an indication of marked ability.

There are many types of successful men in all professions and there seems to be no apparent reason to make an exception of the wire chief by giving first consideration to that which in many cases is indifference, mistaken for a qualification. In some men the failure to become excited and freedom from worry is an indication of a lack of realization of the seriousness of a hazardous condition and the importance of prompt action.

There are conditions arising at times which require an unusual amount of personal interest and enthusiasm from the entire force, and a wire chief or manager who cannot display sufficient interest and enthusiasm to make it catching is deserving of some sympathy.

Creditably to fill one of these positions a man must be a general utility man of wide experience. An up-to-date railway telegraph and telephone installation includes electrical apparatus which requires rare skill to operate and maintain. Knowledge of quadruplex, duplex, repeaters, motor generators, rectifiers, telephone exchange boards, test panels, composites, simplexes, selective signaling devices and many other odds and ends in circuits and equipment is included in the railway wire chief's requisites.

This knowledge cannot be based on any "rule of thumb" method, but must be a practical as well as theoretical education based on an intimate acquaintance with every characteristic of circuit and apparatus.

A wire chief with only a rough working knowledge of his plant is frequently in trouble and as a consequence causes many vexing situations not to the interest of the service.

In addition to his ability as an electrical man a railway wire chief must be a man of tact and diplomacy capable of successfully managing an office, directing operations and maintenance and in general conducting the affairs of his division with credit to the department.

A man may possess the required knowledge of the plant yet fail by reason of arbitrary business methods, or possessing the necessary qualifications as a manager be unable to master the electrical features and fail as a managing wire chief.

A man who succeeds as a managing wire chief ought to be, and is, considered as having excellent qualifications for a train dispatcher and because this is generally recognized we are frequently losing to the operating department some of our most valuable workers.

The loss of one of these high class men is keenly felt; but a man who is ambitious and advances by study and application is justly entitled to the recognition he so receives, and with him should go the very best wishes for the success which his ambition merits.

I am frequently asked to advise operators "how

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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to become a wire chief," and to lay out for them a course of study and practice which will assist them to one of these positions. It it were not of so much importance to both the employer and employee the advice could be simply given and the subject dismissed by recommending some hand book or correspondence course.

Each and every man has some latent ambitions, and when an operator approaches me with the question how to become a wire chief, I feel justified in taking the matter seriously enough to question him as to his experience and education, as well as to make a character study of the man to enable me properly to advise him.

For those who have had high school training and have receptive minds the study of an elementary telegraph and telephone hand book, together with practice under the supervision of an educated wire chief may prove sufficient, while for those who have not had advanced study in mathematics there will be many difficult problems and I recommend a correspondence or night school course in electrical work. A telephone and telegraph engineering course includes mathematics and is to be recommended to any operator who is ambitious to become a successful wire chief.

The mere possession of a contract for a correspondence course or the ownership of a full library of text and hand books will be of little use if the possessor is not willing to work hard in securing therefrom the required knowledge.

When an operator shows an inclination to advance to the position of wire chief I keep him in mind, frequently inquiring as to his progress and encouraging him as a matter of personal interest and for the good of the service.

It is worthy of mention that of two similar wire chief stations one will always be able to fill any vacancies in its own staff and to furnish high grade men for other stations, while the other will have to call for assistance in filling vacancies, never being self supporting in talent.

This is a sure indication of the ability of the staff of the two offices, as a good manager and wire chief will always fortify himself against accident to his staff as well as taking a personal interest in advancing worthy members of his force.

Lehigh Valley Installs Yard Dispatching Circuits

To expedite the work of handling trains in and about its Jersey City yards, the Lehigh Valley railroad has applied to terminal operation the method already employed in dispatching scheduled trains. A telephone system under the supervision of the general yard master with telephone lines extending to every coal pocket, freight house, yard office, switch and other point with which he is required to keep in touch, has been installed. Western Electric selectors and telephones, with which the rest of the Lehigh Valley's extensive dispatching system has been equipped, are being used.

Special equipment was designed for this telephone system. Each office is supplied with a wall set or transmitter arm. At several points, the standard bell in the selector set is replaced with a loud ringing gong, since there is no yard man in regular attendance. Each one of these station sets is provided with a push button, enablng the yard man to signal the dispatcher in case he is not on the circuit by ringing a bell in the yard master's office. A test box by means of which the yard master can quickly locate trouble on the line is also provided.

The yard master is equipped with a cabinet in which are mounted a master calling key and several switching keys. He uses a suspended type transmitter in place of the ordinary dispatcher's chest transmitter set.

It is believed that the Lehigh Valley is the first railroad in the East to apply telephone train dispatching methods to direct car movements in a local yard.

Superintendents Hold Annual Convention

As we go to press there is being held in the city of Boston the thirtieth annual convention of the Association of Railway Telegraph Superintendents. The control of the movement of trains by telegraph or telephone, one of the most important departments of railway operation, had its inception in 1851 when Charles Minot, superintendent of the Erie Railroad, sent the first telegraph train order. This step was regarded with many misgivings by Mr. Minot's associates and while he was confident of the success of his experiment he could have had no conception of the results attained up to the present time. Since that time the telephone has taken its place in railway operation and so efficient has it proven that it is rapidly displacing the telegraph, there being at least one large railroad that has substituted the telephone for the telegraph over its entire system.

This organization had its inception in Chicago in 1882 and the second annual meeting was also held in Chicago in 1883. The sixth annual meeting was held in Boston, 1887, at which time the practice of showing exhibits of telegraphic and other electrical devices was introduced. The association has grown to be one of the most important arms of the railway service and the annual meetings are very profitable both to the members and the railroads they represent, as they afford opportunity for each one to learn what the others are doing in the line of progress and provide for the exchange of mutual ideas and experience to the benefit of all concerned. The association is accomplishing excellent work and aiding very materially in upbuilding the railroad service of the country.

At the meeting held in Chicago in 1883 P. W. Drew, Chicago, was chosen secretary and treasurer, which position he has filled with credit to himself and the association ever since, being re-elected at each meeting of the association.

The twenty-first annual convention was held in Chicago in 1902 and among the important subjects discussed at this convention were the questions of typewritten train orders and the use of telephones in connection with railroad operation. At the convention of 1903, held in New Orleans, the use of the telephone in connection with railway work again received considerable attention. F. F. Fowle, at that time of the engineering department of the American Telephone and Telegraph Company, presented a lengthy illustrated paper upon "The Transposition of Telephone Lines to Prevent Cross Talk and Induction."

All of the most important cities of the various sections of the United States have been chosen for these annual conventions. The one for last year was held at Los Angeles and fully reported in TELEPHONE ENGINEER.

Rules in Telephone Dispatching Practice

By John W. Barney*

A NUMBER of the railways of this country and Canada which have adopted telephone train dispatching have also issued rules and instructions governing the use of the new equipment. These vary from a few general statements in a half-dozen paragraphs, mimeographed, to be sent to employees, on one road, to the handsome, linen-bound pocket book of instructions issued by the Louisville & Nashville Railroad Company. On the Baltimore & Ohio Railroad these rules are incorporated into a 49-page book, covering block signal and interlocking as well as telephone rules. The Canadian Pacific Railway, the Delaware, Lackawanna & Western, the New York, New Haven & Hartford, the Lehigh Valley and the Lake Shore & Michigan Southern rules are admirably concise. Some of the roads, including the Great Northern, the Southern Railway, the Union Pacific Railroad and the Queen & Crescent incorporate in their telephone train dispatching instructions directions for patching circuits, while on other roads like the Erie, the Atlantic Coast Line and others instructions in regard to patching are given orally by the inspector on duty, who is governed entirely by the circumstances in the individual cases. On the other hand there are a few roads which report no specific rules for telephone train dispatching, as it is found that the telegraph train dispatching rules will serve, the telephone being understood to be meant in cases where the telegraph is referred to.

In such survey and study of these rules as the writer has had occasion to make, three points stand out as insisted upon with practical unanimity as essential in rules governing this service. They are: the restriction of the train-order circuit, with more or less rigidity, to messages concerning train movements only; the elimination, and in some instances the prohibition of the use of the word "Hello" in answering telephone calls, and the necessity of repeating or spelling out certain parts of train-order messages to insure accuracy.

The train dispatcher, under the most of these rules, is in absolute control of the train circuit and may assume control of the message circuit when circumstances require. The dispatcher's permission for the use of the train-order wire by officials other than his operators is required on the Atlantic Coast line, the Louisville & Nashville, the Grand Trunk, the Central Vermont and the Evansville and Terre Haute. The Bessemer & Lake Erie excepts from the dispatcher's permission the superintedent, the assistant superintendent, trainmasters, train supervisors, the chief train dispatcher, the road foreman of engines, and line foremen. The Georgia Railroad excepts the superintendent, trainmaster, traveling conductor and traveling engineer. The New Iberia & Northern allows employees to use the telephone circuit on permission from the agent or other person in charge of the telephone, and the Queen & Crescent rules state that the train dispatcher's circuit is to be used exclusively for handling train orders "excepting as may be directed by proper authority."

Following general directions requiring the dispatcher to write orders as he gives them and to underscore words as repeated back for verification, the requirements looking to the insuring of accuracy in recording these oral communications agree upon the principle of verifying by spelling out or by repetition words upon which there is a possibility of error in comprehending, while they differ considerably in the means by which the desired safeguards are to be obtained.

Some of these differences have evidently grown out of the isolated individual formulation of rules and are not significant as tending to establish principles. The requirements of repetition by spelling or otherwise cover, generally, order, train and engine numbers, and station names, and in some cases are extended to cover track numbers and names of conductors. The larger number of roads using telephone train dispatching require that names and figures shall first be pronounced and then spelled out, while about a quarter as many roads call for the spelling first and the pronouncing later. The rules of two roads call for the pronouncing and repetition of names and numbers without requiring the spelling out, two others call for spelling without providing for the sequence of operations or the manner of spelling and one line requires only the repetition of figures but does not provide for spelling out, nor indicate the manner in which they are to be repeated. One road appears to be supercautious in reversing its requirements for the two classes of figures. Thus time figures are required to be first spelled and the numerals then pronounced, while train and engine numbers must first be pronounced and the figures then duplicated.

In the treatment of the cipher, practice varies, a number of roads calling for the spelling out "n-a-u-g-h-t" or "n-o-u-g-h-t," while a smaller number use "O," in one instance the rule calling for the use of the syllable "Oh."

In multiples of ten some of the principal roads spell out as one word, thus: "f-o-r-t-y," while others require "f-o-u-r O" or f-o-u-r n-a-u-g-h-t." One road, however, directs that ten shall be spelled out as "o-n-e O."

In double numbers the rules show variations. The number 12 may be sent as "t-w-e-l-v-e" or as "o-n-e t-w-o" under differing rules and in such numbers both the examples following are authorized and required by different rules: "52, f-i-v-e t-w-o," "92, n-i-n-e-t-y t-w-o."

In larger numbers 100 may be spelled: "o-n-e n-a-u-g-h-t, n-a-u-g-h-t" or "o-n-e d-o-u-b-l-e O." One thousand may be spelled, according to one set of rules: "o-n-e t-r-i-p-l-e O."

In mixed hundreds, in figures like 305, for example, "naught" or "O" are good practice, according to different rules. One road authorizes the spelling of mixed numbers of three places as: "o-n-e e-i-g-h-t-y s-e-v-e-n," while the larger number of roads require, in such cases, the spelling of each figure separately.

In numbers of four places opinion seems to be divided, according to the rules at hand. The following examples of authorized practice are taken from the

*Of the United States Electric Company.

several instructions, the hyphen denoting those words required to be spelled a letter at a time:

"2550, t-w-o f-i-v-e f-i-v-e n-a-u-ght."

"F-i-f-t-y n-i-n-e n-i-n-e-t-y e-i-g-h-t, Five, nine, nine, eight."

"O-n-e t-h-r-e-e o-n-e f-i-v-e. Thirteen fifteen."

"2835, 2-8-3-5, Twenty-eight, thirty-five."

In time numerals the general practice seems to be to follow colloquial usage in spelling out hours and minutes, time being given in minutes past the hour, as: "1, o-n-e hour 45, f-o-r-t-y f-i-v-e minutes;" "6:15, s-i-x f-i-f-t-e-e-n."

Many of the rules insist upon the exercise of the utmost care to obviate liability of misunderstanding or error. Two companies, the Southern and the Northern Pacific, have endeavored to guard against phonetic pitfalls due to the similar sounds of P, B, T, D, etc. The Southern rules suggest that the alphabet be called in such cases, as: P, N-O-*P*; B, A-*B*; while the Northern Pacific rules direct the spelling out of the letter for identification, thus: T, tea; B, bee; C, see, etc.

Although a number of the rules require the use of a conversational tone of voice in transmitting orders and reports and impose care in the use of the telephone, and a prescribed position with respect to the mouthpiece of the transmitter, the important subject of the use of the instrument is treated in none of the rules more fully than in the booklet of the Louisville & Nashville Railroad Company. One of the commonest faults in the use of the telephone is the failure to speak properly into the transmitter. The need of in struction is so general as to warrant the mention here made, which is drawn mainly from the Louisville & Nashville rules.

It is not necessary to talk in a loud or sharp tone of voice into the telephone transmitter, as the only result will be to confuse the voice vibrations and render the utterance unintelligible to the receiver. For the best results the mouth of the speaker should be within about one-half inch of the mouthpiece of the transmitter and the speaking should be in a tone somewhat lower than in ordinary conversation. Words should be pronounced slowly and distinctly, a monotone being recommended, with no emphasis or inflection. It is desirable that all syllables should be pronounced without slurring, while the "r's" may be slightly rolled, as we hear from central station operators in the larger cities. While speaking the mouth must not be averted from the instrument, as the vibrations will then fail to enter the transmission orifice and be lost. The position of the transmitter mouthpiece should be inclined slightly upward from the horizontal. Under no circumstances should the diaphragm of the transmitter be hit or touched.

The receiver should set snugly against the ear, not only to prevent the entrance of external noises but because the increase by even the fractional part of an inch of the distance of the diaphragm from the ear may be equivalent to the loss in transmission efficiency represented by a hundred or more miles of wire. If, when the foregoing requirements are observed, the message cannot be heard plainly, the fault is on the line or in the receiver, though seldom in the latter. If the receiver is at fault, the rubber cap should be removed and the magnet terminals examined and cleaned of dust or dirt. Care must be exercised in handling the diaphragm to avoid denting or bending it in the slightest degree. It should be handled as little as possible. In cases where it is surmised that the strength of the magnets has failed, it may be tested by taking the metal diaphragm and placing its edge across the magnet poles. If it is supported while the receiver is held in an upright position, the magnetic action is good; but if not, the receiver should be replaced immediately.

Receiver and transmitter cords should never be twisted or allowed to remain in that position, if so placed by accident. The small wires inside the cord will become broken and make the telephone noisy and unsatisfactory. A defective cord may be detected by holding the receiver to the ear and shaking the cord. If it is broken or not making perfect contact, it makes a grating noise in the receiver. No weights or pulleys should be attached to the cords under any circumstances, and no moisture should be allowed on or near them.

Frequent inspection of binding posts is necessary. A loose connection, while it may not cut out the service altogether, will lower transmission and make the telephone unsatisfactory. The telephone must not be allowed to come in contact with telegraph keys or other telephone instruments. Metal articles should never be placed on or near the telephone instruments; such articles are likely to short circuit the apparatus and cause trouble.

The rules do not alter the force of the "O. K." or "Complete" of the telegraph service, but they agree substantially upon "Right" or "All right" as acknowledgment of an order, and on brevity of statement in answering calls, both on the part of the dispatchers and operators. They are at practical unity in forbidding any changes by operators in the wiring or equipment of the telephone train dispatching service and in requiring the prompt reporting of all trouble on the circuit to the dispatcher.

Columbia and Puget Sound Adopts Telephone

The Columbia and Puget Sound has joined the ranks of the railroads which favor the telephone method of dispatching trains, and has ordered from the Western Electric Company at Seattle, selectors and associated telephone apparatus for a circuit about thirty miles in length.

The dispatcher for this line will be located at Seattle. Way station telephone equpments will be installed at Indian, Argo, Black River, Maple Valley and Renton. The line will be constructed of 10-gauge hard drawn copper wire.

The railway telephone has gained a strong foothold in the northwest, where it is replacing the long-established telegraph for handling train movements on a large number of the more important roads, including the Canadian Pacific, Chicago, Milwaukee and Puget Sound, Great Northern, Northern Pacific, Oregon Short Line and the Spokane, Portland and Seattle.

Another Western Road to Dispatch by Telephone

The Western Electric Company has recently received an order from the Oregon-Washington Railroad and Navigation Company for telephone train dispatching equipment for a circuit from Portland, Oregon, to The Dalles, Oregon, a distance of ninety miles. This circuit will be equipped with seventeen stations.

Recent Developments in Railway Telephony

By Gregory Brown*

IN giving a value to a certain quality and volume of transmission it is said to equal a certain number of miles of cable. This means that the number of miles stated is such that when standard instruments are used for this distance over No. 19 gauge telephone cable of 0.06 microfarads capacity per mile, the value of transmission will be the same. It is considered that the commercial limit of good transmission is 30 cable-miles. This value can be equated in terms of any other wind of circuit. One mile-cable loss is equivalent to the loss sustained in 16 miles (25.7 km.) of No. 9 B. & S. copper and as this is the standard size of wire used on dispatching circuits, it will be seen that the line may be 480 miles (772 km.) long before the so-called commercial limit is reached. This is considerably longer than any of the circuits in use, there being but few over 250 miles (402 km.) in length. There is, therefore, a surplus of transmission available which can be taken advantage of in arranging circuits to permit several operators to listen in simultaneously. The loss occasioned by the selector bridges is almost negligible, the impedance to talking frequencies of the W. E. selector being about 90,000 ohms. This value is such that the loss sustained when forty selectors are across the line is only one mile of cable.

The first form of substation talking circuit used on train wires was the standard local battery circuit, which is schematically shown in Fig. 16. It will be seen that during conversation the condenser, receiver and secondary of the induction coil are in series. The resistance of the secondary of the coil used was 20 ohms, and of the receiver 70 ohms, a two-microfarad condenser being used in series. The total impedance of this bridge to taking current is approximately 600

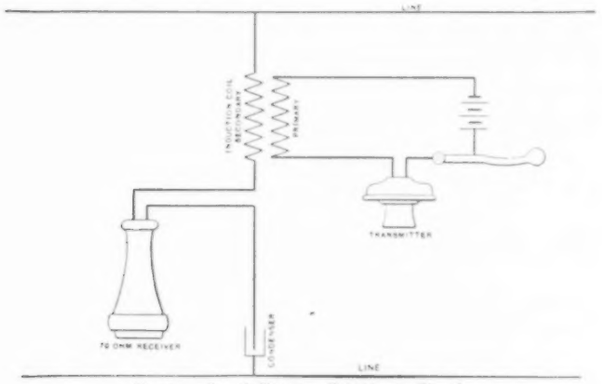


Fig. 16. Local Battery Telephone Circuit.

ohms, about 300 ohms of which are active for receiving purposes. It is obvious that when a number of these sets are bridged across the line at once, the joint impedance of the parallel paths is very low and the transmission correspondingly difficult between widely separated stations.

The first step towards overcoming this difficulty was to raise the impedance of the talking bridge by the use of a different induction coil, wound with a low primary and a high impedance secondary. This bettered matters somewhat as the higher resistance bridges produced a more even distribution of the talking current from the dispatcher's office, and would give better outgoing transmission from the substations. Although the dispatcher's voice currents

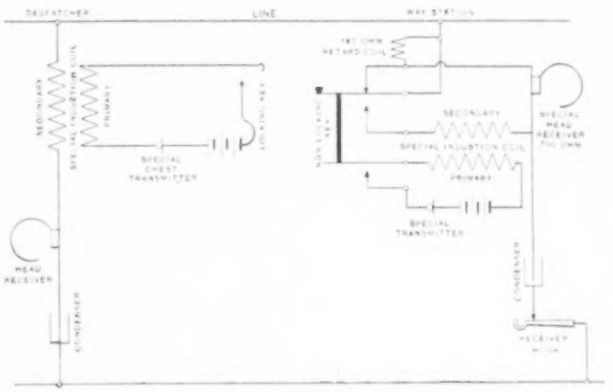


Fig. 17. W. E. Train Dispatching Way Station Circuit.

were undoubtedly better distributed among the bridges with this arrangement, still, due to the fact that the bulk of the impedance in the bridges was in the secondary of the coil, the receiver having a resistance of but 70 ohms, the transmission gain was very slight.

The next obvious step would be to maintain the high impedance in the talking bridge but put as much of this impedance as possible in the receiver. If this were done, however, the high impedance receiver in series with the secondary of the induction coil would reduce the outgoing transmission from the substation to an objectionable extent. It was then determined that the best results, both for receiving and transmitting, would be obtained by installing a switching arrangement at the substation so that when the switch was in one position the circuit was in the best possible condition for receiving and when in the other position was in the best possible condition for transmitting. The circuit developed is shown in Fig. 17, the circuit to the left representing the dispatcher's station and to the right the way station.

It will be noted that a non-locking push button is located at the way station and in its normal position the bridge across the line consists merely of a 700-ohm receiver and a one-microfarad condenser. The impedance of this receiver is about 2,500 ohms and as the total impedance of the bridge is all in the receiver it is all effective for receiving purposes.

When the operator wishes to talk he depresses the push button or in some cases a foot switch which closes his local transmitter battery circuit and also connects the secondary of his induction coil to the line. The voice currents generated in the secondary have a path directly across the line in series with the condenser and also a shunt path through the retardation coil and receiver in series. This retardation coil is of about

*Abstract of a paper presented at the Pacific Coast meeting of the A. I. E. E., Los Angeles, Cal., April 25-28, 1911. Concluded from June.

6,000 ohms impedance and is placed in series with the receiver in the manner shown; in order that the dispatcher may break in it is necessary for him to interrupt an operator while talking. The impedance values are such that the amount of side tone is just sufficient for the operator to distinguish the dispatcher's voice if he interrupts and he will release his button in order to clearly understand what the dispatcher is saying. The outgoing transmission of this circuit is, therefore, the best possible consistent with the fact that we must arrange to permit the dispatcher to interrupt the operator's conversation when necessary.

The induction coil used in the way-station and also the transmitter are especially designed for railway work. The transmitter button is of medium resistance and while not taking excessive battery current still varies the current through a large range and gives good volume and articulation with three cells of battery.

When the receiver is off the hook, this circuit reduces the transmission by about one mile of cable, for stations beyond that are receiving from the dispatcher. One hundred and thirty miles (209 km.) No. 9 copper

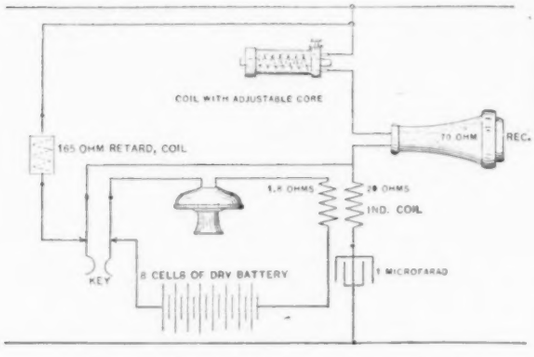


Fig. 18. Adjustable Coil Way Station Circuit.

Fig. 19. Patching Box.

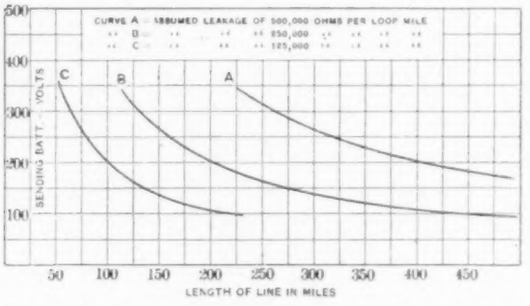


Fig. 22. Intercommunicating System. Curves show relation between line voltage and length of line. System can be operated over assuming a definite leakage per loop mile (with no readjustment of sending relay).

being the average length of dispatcher's line, the line transmission loss at 16 miles (25.7 km.) of wire to one mile (1.6 km.) of cable, will be eight miles (12.8 km.) of cable, leaving an equivalent in transmission of 22 miles of cable that can be used in the bridges before we reach 30-mile (48-km.) transmission for the last station. Thus it will be seen that on a line of this kind 22 operators can be listening in and good transmission can be maintained. It is practically never necessary that this number be on the line, 15 being a liberal estimate of the number of receivers that will be off the hook at one time. If, however, emergencies should arise making it necessary for 25 or 30 operators to listen in, transmission will be sufficiently good for the transaction of business, even though it is beyond the 30-mile limit.

The requirements of the dispatcher's circuit are somewhat different from those at the towers. He must be on the line all the time and the transmission and receiving of his set must be as good as possible, without resorting to the use of a push button for talking and listening, as his time is too fully occupied to permit him to use this device.

The circuit is shown at the left of the figure. A 70-ohm receiver is used in series with the secondary of the same type of induction coil, as is used at the substations, and a one-microfarad condenser in series. The impedance of this bridge is about 650 ohms and it being the lowest on the line, the receiving will be good. This value also permits good transmitting. The switch shown in the figure is of the locking type and opens the battery circuit when the set is not in use. Another form of the substation circuit developed for the way-station is shown in Fig. 18. This arrangement is somewhat similar to the one previously described and contains a push button to operate when talking. Under normal conditions, that is, when the push button contacts are open, the path of incoming voice currents is through the adjustable retardation coil, 70-ohm receiver, secondary of the induction coil and condenser. The impedance of this retardation coil is adjustable by means of a sliding core and the various stations are adjusted with reference to their distance from the dispatcher's office, the furthest station on the line having the least impedance. When the button is depressed for talking the transmitter battery is closed and a retardation coil is placed in shunt around the adjustable coil and receiver. This cuts down the impedance of the bridge for outgoing voice currents and still permits of enough side tone so that the dispatcher can break in on the conversation. The impedance of the bridge under these conditions, however, is considerably higher than in the previous circuit described and for this reason it is advisable to use more local battery current, as many as eight cells being sometimes used for this purpose. This, of course, is somewhat objectionable in that it tends to decrease the life of the transmitter. The impedance of the receiving bridge with the core all in the adjustable retardation coil, is about 4,300 ohms, and all out is 1,200 ohms. A bridge of 4,300 ohms is equivalent to 0.6 mile-cable loss and 1,200 ohms to 1.8 mile loss, or an average of 1.2 miles loss for each station on this circuit.

PATCHING.

In order to facilitate testing and maintain service on the train wire in the case of line trouble, it is customary to loop the various lines on the pole into every station or every few stations, through patching boxes. A typical box is shown in Fig. 19 and its circuit arrangement in Fig. 20. The wires entering the tower are connected to the jacks at the left, the connection passing through the cutoff contact to the jack at the

right and from thence back on the pole line. Two locking keys are provided, arranged so that the selector and telephone set are normally connected to the train wires but by operating the key they are connected to two pairs of cords. When a train wire gets into trouble, the operator can cut off the line beyond his station by inserting any plug in either one of the train wire jacks. This operates the cutoff contact and opens the line. When the trouble is located between any two towers, the operator at the tower nearer to the dispatcher throws his key, placing a plug of one pair in the incoming train wire and the other plug of this pair into the wire which he is going to use for patching. He also places one plug of the other pair in the other side of the incoming wire, placing its mate in the other side of the outgoing wire. This will connect the incoming train wires to the outgoing pair of wires to be used for patching. The operator on the other side of the break, plugs in such a way that the patching wire is again connected onto the train wire. The patching box is equipped with a grounding jack so that any line can be grounded for test.

The foregoing describes in a general way the manner in which the telephone has been adapted for use on train wires. The second class of service in which the telephone is replacing the telegraph is on message wires.

MESSAGE WIRES.

A telegraph message wire extends throughout a division and is generally cut in to all the offices on the division. It is used for the transaction of miscellaneous railway business between division and intermediate pionts. It is also used in a great many cases for sending commercial telegraph messages, when the railroad and telegraph companies employ joint operators. In addition to the above uses, the message wire is usually used for sending time to the various towers. It is extremely important that the clocks at the offices along the line be correct, as even a comparatively slight difference in the indicated time between the dispatchers' and substation offices may cause serious re-

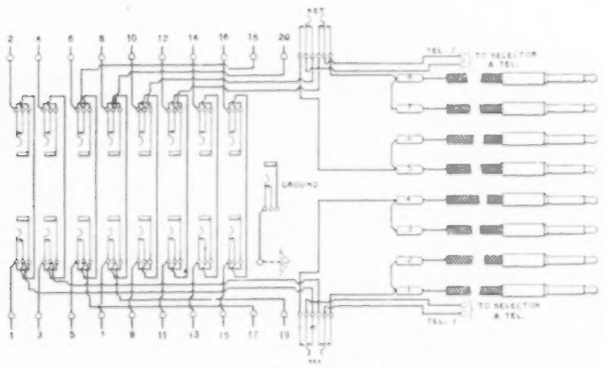


Fig. 20. Patching Box Circuit.

sults to follow. In order that the accuracy of the various clocks may be regularly checked at a certain time each day, and on some roads twice a day, a certain number and arrangement of dots are sent out on the telegraph line in such a way that they indicate to the various operators the exact time, thus permitting the operators to properly set their clocks, if such action is necessary. From the above it will be seen that the requirements which the telephone must meet for this class of service are:

1. To selectively signal on a line whose characteristics are in general the same as a train wire, but that the selective signaling should be capable of being performed by any operator on the line. In other words, selective signaling arranged for intercommunicating work.

2. The ability to simultaneously signal all the operators so that time may be given.

The telephone has been in use for message work on a number of wires in which all the calling is done by one operator, thereby differing somewhat from tele-

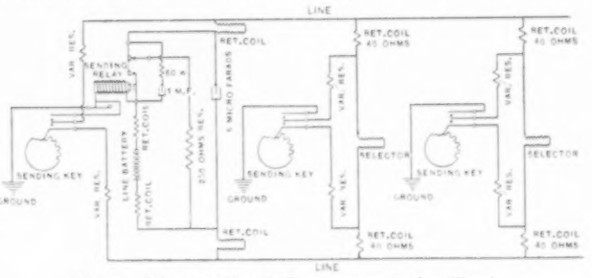


Fig. 21. Western Electric Intercommunicating Circuit.

graph operation. Circuits, however, have recently been developed for inter-communicating work which give satisfactory service. Probably the one having the widest margin of operation was developed in connection with the step-by-step selector and is shown in Fig. 21.

The condensers and retardation coils at the dispatcher's end, for reducing the noise of sending, are arranged practically as in the standard train wire circuit. Each substation is equipped with a sending key, so connected that its operation will place impulses on the line from ground through the center of the resistance, over both sides of the line, through the point *A*, thence through the battery and sending relay to ground. The operation of this relay places current impulses metallically on the line and operates the selectors at the various stations, the selector used being the standard type used on train wires. Modifications of this circuit arrangement are in use for this purpose, but the difficulty that has heretofore been encountered has been that with a grounded relay, the line leaks are liable to be sufficient to either operate the relay or hold it in its operated position. The glass insulators on a pole line along the right of way of a railway are constantly subjected to the smoke and soot from the locomotives. This almost invariably causes the insulators to become permanently coated with soot and when wet weather sets in, the leaks to ground on railroad lines probably average considerably higher than is found to be the case in commercial practice. The circuit shown was designed to neutralize as much as possible the effects of line leakage in so far as it affected operation. It will be noted that when any station is sending, current flows from ground of that station over the upper line wire as shown in the figure, to a normally closed contact of the relay, through this contact to the point *A* on the lower line wire, and then through battery and relay to ground. The contact arrangement is such that the making of the normally open contact breaks the normally closed. This cuts off the current from the upper line wire and doubles the resistance for grounded current, thereby cutting the current through the relay in half. The relay being in its operated position, this current is sufficient to hold it. As the first effect of line leaks

would be to hold the ground relay closed when it was operated, the arrangement shown largely overcomes this tendency. The taper resistances used in connection with the keys at the substation are arranged so as to give the grounded relay the same current from any substation. The curves shown in Fig. 22 show the margins of operation of this system for various lengths of line and operating voltages. For an average line of 130 miles (209 km.) and 160 volts, the line leaks can be as low as 125,000 ohms per mile, without interfering with operation. This is equivalent to about 960 ohms ground leak, which is a value that would seldom be met with in practice.

The manner of sending out time is as follows: Referring to Fig. 12, which is the local substation circuit of the Western Electric selector, it will be noted that when the selector closes the lower contact, the local battery current goes through the bell winding, but in its path is not included the vibrating contact. This will cause the bell to become single stroke in action.

Referring to Fig. 11, which shows the selector, the platinum contact on the stop piece will be made simultaneously on all the selectors when a sufficient number of impulses have been placed on the line. When time is to be sent, the wire chief at the division

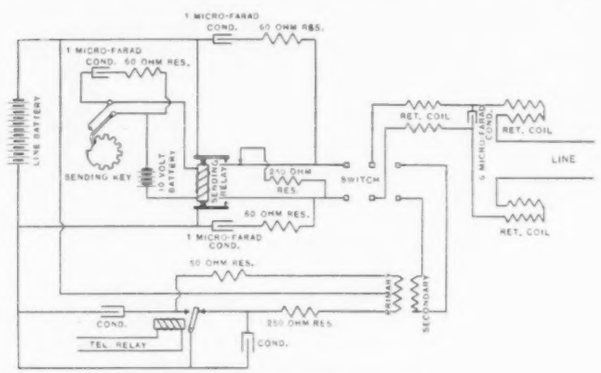


Fig. 23. Time Sending Circuit.

point operates a special key which steps all the selectors around to their time contact point and holds current on the line. The circuit at the division point is so arranged that the contact of the telegraph relay receiving time makes and breaks the current on the message wire. The interval of no current on the line is so short that the slow acting member of the selector does not fall back, but the time contact is made and broken, which taps the bell, and reproduces the signals which were formerly heard on the sounder.

This is the method used to send time when local battery bells are used. If the same manner of tapping the bells were employed in circuits where waystation bells are rung by the dispatcher's battery, the amount of current required to operate all the selectors and ring all the bells at once, would tend to cause such an excessive current flow that the amount of voltage drop on long lines would be such that satisfactory operation could not be obtained. Another arrangement, Fig. 23, was therefore developed for sending time on the central ringing systems. When time is to be sent on the line, the wire chief at the division point throws a switch which connects up the circuit as shown. The secondary of a repeating coil or transformer is connected across the line and the middle point of its primary connected to one side of the main battery, the other two ends of the primary winding being connected to the front and back contact of the telegraph relay, which operates in accordance with the time impulses being sent from the distant point. Resistances are introduced in the leads from the relay contacts in order to limit the amount of current and condensers are used to reduce the sparking. It will be seen that as the relay operates, there will be generated in the secondary of the coil and sent out on the line an impulse or kick, alternating in character. There is placed in series with the selector at each of the substations an ordinary 1,000-ohm polarized telephone bell. These bells are operated every time a secondary impulse is sent out. After time has been given and the wire chief has opened his switches, leaving the lines in normal condition, the first impulse sent out by the dispatcher when he calls a station, may be of such polarity that it will cause some of the bells to tap. There will only be one tap heard, however, as the bells will remain in the position to which they have moved. This circuit arrangement obviates any danger of stepping the selectors up which might be the case where the contacts of the time repeating relay connected directly on the line. The fact that the polarized bells at the substations are unbiased and will not be affected by reversal of line wires, is another advantage of this system.

Up to the present time, most of the railroads are still giving time over the telegraph, as there are but few instances of divisions where there are no longer telegraph instruments in the towers. There are, however, divisions on some roads in which the telephone has replaced the telegraph entirely, and on these divisions, time is being given over the telephone circuit.

In addition to the use of the telephone for train dispatching and message work, it has also come into very extensive use for block wire service.

BLOCK WIRES.

The length of a block wire ranges from one-half mile (0.8 km.) to six or eight miles (9.6 or 12.8 km.) and the service required of the telephone for blocking purposes is merely to maintain communication between two block towers. There are no new features required of the telephone for this work. A great many of the roads are using the existing telegraph wire between blocks for a grounded telephone circuit. This will, of course, introduce some noise in the telephone, but the line being short, this is not generally objected to. If a satisfactory loud-speaking receiver could be produced, it would undoubtedly be very generally used for blocking purposes. If this instrument were used, no signaling device would be necessary, as by simply throwing a key and talking into this transmitter, an operator can call the adjacent tower. This arrangement would also have the advantage of permitting the operator to be handling his levers or doing other work, and still receive the message. Loud speakers have recently been developed and are now being experimentally tried out on a division of one of the roads. The results so far obtained indicate that it will be advantageous to use these instruments for blocking service.

It is very often the case that besides the block wire, there are one or two short party lines reaching from the tower to siding telephones, residences of employes, etc. The hand generator and code signaling is in general use for signaling between blocks and on these party lines. In order to relieve the load of the

operator somewhat, an interrupter has been developed, and is arranged so that code ringing can be performed by means of a push button. Fig. 24 shows a schematic diagram of this interrupter. A very efficient type of transformer is used in this instrument, and with six dry cells in the primary circuit, twenty 2,500-ohm bells can be rung on a 500-ohm line.

In addition to the service performed by the telephone on railroads, as has been described in this paper, it has facilitated railroad business in several other ways. Telephones are used very extensively at sidings. These telephones are generally connected with the dispatcher's wire and train crews can immediately get in touch with the dispatchers, and a great amount of time can be saved. There has been put on the market a semaphore type of signal in the base of which is mounted a telephone and selector equipment. In case the dispatcher wants to stop a train and call the conductor to the telephone, he can do so by operating the selector which throws the signal.

Portable telephones have also come into pretty

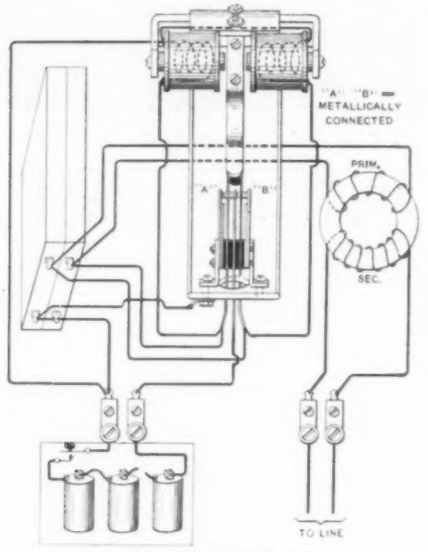


Fig. 4. Substation Circuit.

general use. On some roads, every train carries a portable telephone and a line pole. The line pole is jointed for convenience in carrying and can be quickly assembled for use. It is equipped with two metallic hooks at its upper end which the conductor can connect with the dispatcher's wires on the pole line and thereby get into communication with him.

Although the telephone has been in use on railroad divisions for less than four years, it has proven to have a great many advantages over the telegraph which the railroads were quick to appreciate, and at the present time, there are about 37,000 miles (59,545 km.) of road equipped with the telephone, and there have been no instances so far in which accident of any kind can be traced to the use of the telephone for railroad work.

A paragraph in the will of Norman Enright, which was probated in Seattle, Wash., recently, reads:

I hereby bequeath the sum of $1,500 to be used under the supervision of a responsible city official, for the purpose of substituting and straightening all the crooked and slanting telephone poles in the business and residence districts of Seattle.

Portable Telephone Sets On Electric Railway

Since the perfection of the telephone selector, the telephone has been rapidly replacing the telegraph as a means of dispatching trains on the leading steam railroads of the country. At present the movements of trains on over 48,000 miles of track are being directed by the telephone, 13 railroads having over 1,000 miles thus equipped. On electric railways the selector

Fig. 1—No. 1330-F Portable Set using No. 186 Plug and Jack.

equipment is not used to any extent, as it is not in most cases necessary. The telephone, has, however, come into quite general use, as this means of communication not only provides the safest, quickest and most efficient means of handling train service but in addition furnishes the best known method of handling routine and emergency business.

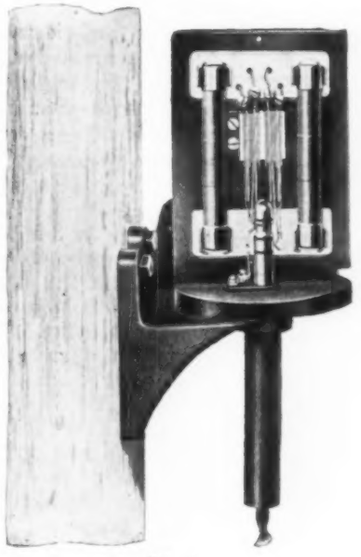


Fig. 2.
No. 186 Jack. Open View.

When the telephone is used there are two general methods of handling the train movements. The general idea of both is the same; that is, to install a telephone switchboard with a line or lines paralleling the road. The systems differ in that on one a stationary telephone set is located at important points along the

line from which the train crew can telephone the dispatcher; while in the other no stationary sets are used, but instead a portable set is carried on each car, and at frequent intervals of, say, one-half mile, a jack is mounted on the telephone pole. When the conductor wishes to communicate with the dispatcher he simply inserts the special plug provided with the portable set into the jack. Fig. 1 shows a conductor using one of the portable sets.

Both of these methods are used to a large extent, and each has its advantages. Because of lesser first cost the portable set method is becoming more popular each year. When the jacks are spaced at interevals of 'one-half mile, it is never necessary to walk over a quarter of a mile to the nearest pole'; and in cases of emergency, such as an accident to the car, the roadbed or the line, the time saved by being able to get into immediate touch with the dispatcher or superintndent is invaluable.

On interurban lines operating on single track it is customary for scheduled trains to meet at certain points designated by the dispatcher. Delays often cause one train to arrive at a meeting point only to find that the car which was to pass it has not arrived. Unless a means of communication with the dispatcher is provided, it would be necessary for the car arriving first to wait until the other car appeared or until information as to its movements was furnished. Of course, with portable telephone equipment the exact location of the other train could be learned at once, for in case of accident or delay the first duty of the other train crew would be to notify the dispatcher.

The No. 186 jack, recently put on the market by the Western Electric Company, and shown in Fig. 2, has been designed especially for railway work and has some interesting features. The jack proper is furnished with a cast-iron cover and is arranged for mounting on a pole. A lock is provided which makes it impossible for anyone except the maintenance men to remove the cover. Since the telephone is mounted on the same pole, and often near the power wires, it is necessary to provide suitable protective equipment. In the No. 186 jack this provision is made by using two 500 volt, one-ampere fuses.

It is also necessary that the person using the portable set, and the set itself, be protected from any ground or lightning discharges on the line, and this is provided for in the No. 186 jack by means of two open space cut-outs. Since protection is necessary only when the portable set is in operation, this cut-out is not normally across the line, but is put across when the plug enters the jack. The tip of the plug is not connected electrically with the portable set, and as it enters the jack it presses the two springs which make connection with the protector blocks, thus putting the protector blocks across the line before connection is made with the set. These protector blocks take care of any discharge which may be on the line and give full protection to both the operator and set.

The hole through which the plug enters the set is provided with a flap, which is closed when the plug is withdrawn. This prevents dirt or insects from entering the set proper. Each jack is provided with permanent leads about two feet long, with which connection can be made to the main telephone line. These leads enter at the bottom of the set through an iron pipe. This pipe is filled with a compound which prevents moisture, dirt or insects from entering the set.

Telephone Dispatching Results on the Pere Marquette

About a year ago it was thought by the officials of the Pere Marquette that if they installed a telephone train dispatcher's circuit on their line between Saginaw and Toledo that they would be able to avoid the regular yearly expense and inconvenience of splitting the

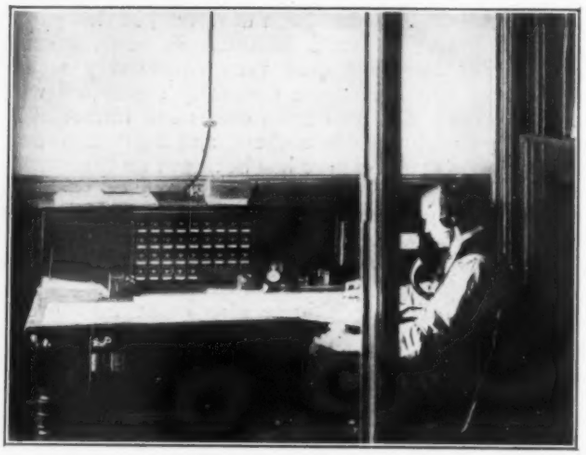


Fig. 1. Dispatcher's Equipment on the Pere Marquette.

division and putting on an extra set of dispatchers during the busy season.

After a careful investigation and a thorough study of their conditions compared to similar conditions on other roads, it was concluded that the experiment was worth while, although the expense would be considerable. Accordingly, the line was put up and equipped

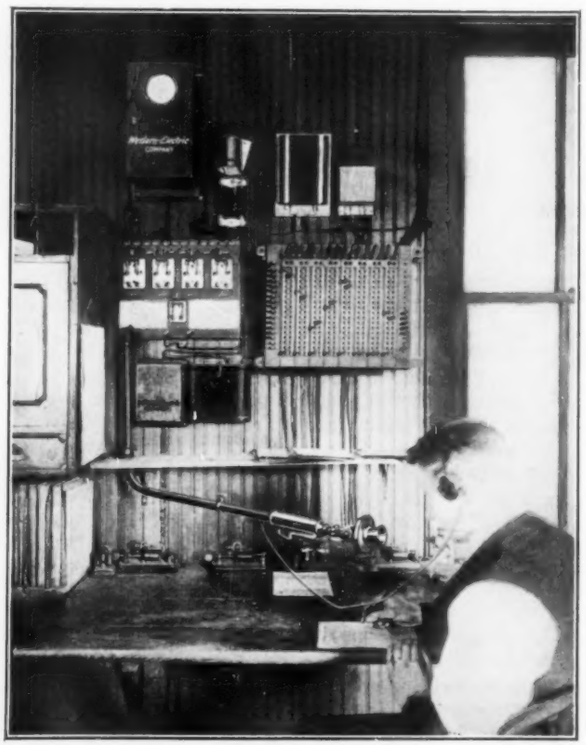


Fig. 2. Way Station Equipment on the Pere Marquette.

with the latest type of selectors and telephone equipment.

As this piece of track was about as busy as any single track to be found anywhere, speed of operation was one of the features to be considered. Because of its speed of operation and high efficiency the Western Electric selector was specified and put in on trial. The performance of this equipment thoroughly met the requirements of the service and not only eliminated the necessity of an extra set of dispatchers but made the work of the dispatchers easier during the rush than ordinarily during the dull season.

Some of the savings effected here can be easily computed, and in the dispatcher's office alone enough was saved in operation to pay a good rate of interest on the total cost of the circuit.

The saving in overtime of train crews cannot be readily estimated, as so many things enter into such a proposition. The increased traffic made possible by eliminating order delays is another feature not readily computable. This is a very important factor on any road that is at all busy, and when the road is working near the limit, as in the case of this division, it means an increased revenue at a reduced cost of operation.

The apparatus used on this dispatcher's line is shown in the accompanying illustrations. Fig. 1 shows the dispatcher's office, which is very conveniently and efficiently arranged and equipped.

It will be noted that the dispatcher's room here is separated from the noisy telegraph office by a glass partition, thus taking away all the tendency to distractions incidental to a number of people in one room and the noise of the operating sounders.

The way station equipment shown in Fig. 2 is an excellent example of way station apparatus and requires no comment other than the convenient location selected.

The operation of the apparatus is pronounced by the railway officials as perfect. In fact, the experiment on this division has proven so successful that three more circuits are being installed at present, and it is the hope of the operating officials to complete the installation of telephone train dispatching over the entire system at an early date.

In addition to the regular equipment for train dispatching, this circuit is equipped for a simplex telegraph circuit from Saginaw to Plymouth, connecting to the Detroit wire at the latter place.

A Study of Telegraphic Transmission

By Frank F. Fowle*

VIII. EXPERIENCES WITH COPPER-CLAD STEEL WIRE.

THE copper-clad steel wire manufactured by the Duplex Metals Company has not been on the market or in actual service more than a few years. Consequently it is impossible to obtain the results of actual experience as to its useful life in service. However, considerable quantities of this material have gone into use in the last two or three years, and much of it is under the supervision of persons competent to report on its behavior up to this time.

I have communicated with the users of about 13,000 miles of this wire, in sizes from No. 9 to No. 12 B. & S. gauge, bare and insulated, who have had it in telephone and signal service anywhere from a few months up to two or three years. They report no weakness in the weld; no scaling or cracking of the copper; no corrosion of the steel and no evidence of these things. There has been no difficulty in handling or erecting the wire beyond the fact that light, thin sleeves are not suitable for making joints, because of the excess of stiffness of this material over copper of the same size. Standard heavy sleeves give no trouble.

Where sleet storms have been experienced, copper-clad has been found much superior to copper of the same size, and No. 12 B. & S. copper-clad has been found to compare very favorably with No. 9 B. & S. copper, as to tensile strength and the frequency of breaks. In those cases where the wire was purchased under specifications, it was not reported to have fallen short of the requirements in any instance.

So far as I can learn from the experience and observations of these users, the statements and conclusions given in this report as to the mechanical properties and stability of copper-clad steel wire are substantiated by the use that has been made of it up to this time.

The material will have to remain in service many years before its life will be known definitely. The assumed life of 50 years is based upon the experience with copper wires and upon the assumption that no steel corrosion will occur. Such corrosion has not been reported up to this time and the tests made to determine its possible existence and extent do not show that it is to be feared. The numerous tests made to determine the strength of the weld show that it is firm and durable. The tests show likewise that the copper coating is similar in structure to hard drawn copper and substantially of uniform thickness, without flaws or cracks. It is apparent therefore that air and moisture cannot be in contact with the steel except at the ends of the wire. The tests made to ascertain the progress of end corrosion have been referred to; they show that it ceases at an early stage. These considerations all tend to uphold the assumption of a long life, without alteration of conductivity or tensile strength.

IX. CONCLUSIONS.

1. Copper-clad steel wire possesses greater tensile strength and a higher per cent of elastic limit than copper or iron wires of the same size.

2. Copper-clad steel wire possesses less conductivity than copper, but more than iron, for wires of equal size.

3. The tensile strength of copper-clad wire is vested principally in the steel and the conductivity principally in the copper.

4. The inductance of copper-clad wire is greater than that of copper and less than that of iron, for wires of equal size. The inductance of small wires is greater than that of large wires.

*A report on the use of copper, iron, and copper-clad steel wires in telegraph service, made to Frank R. Chambers, Jr., vice-president of the Duplex Metals Company, August 1, 1910. Concluded from the June number of TELEPHONE ENGINEER.

5. The electrostatic capacity of copper-clad wire is equal to that of copper or iron of the same size. The capacity of small wires is less than that of large wires.

6. A telegraph circuit of No. 9 B. & S. gauge copper has a working limit, for through simplex service, in all weather, of 437 miles.

7. A telegraph circuit of No. 8 B. W. G. iron of *B. B.* quality has a working limit when new, for through simplex service, in all weather, of 252 miles; when aged so that its resistance has increased 50 per cent, the limit is 208 miles and when aged to double resistance, the limit is 182 miles.

8. A copper wire of no more than adequate conductivity for lines from 200 to 300 miles in length, has inadequate tensile strength.

9. A new iron wire of adequate conductivity for lines over 300 miles long, costs more annually than No. 9 B. & S. gauge copper, at present prices.

10. Copper-clad steel wires combine strength and conductivity in different proportions from either copper or iron. Copper-clad wires have working limits, for through simplex service, in all weather, as follows:

No. 9 B. & S.	293 miles
No. 10 B. & S.	263 miles
No. 11 B. & S.	237 miles
No. 12 B. & S.	213 miles

11. No. 10 to No. 12 copper-clad wires can be substituted for No. 9 copper, at less annual expense, for lines of the lengths given in paragraph No. 10, with equal or greater reliability in service.

12. No. 11 and No. 12 copper-clad wires can be substituted for No. 8 iron, at less annual expense, when the price of copper is not abnormal.

13. In comparison with a through circuit of No. 9 copper, 437 miles long, without repeaters, No. 11 or No. 12 copper-clad, with repeaters at the center of the line, can be substituted at less annual expense.

14. The economic field for copper-clad wires is found in the circuits less than 263 miles long, without repeaters. When repeater stations can be provided every 200 to 250 miles, its field is limited only by the permissible number of repeater sets for good service.

15. The disadvantages of copper in comparison with copper-clad are: low elastic limit and possibility of stretching; weight so related to tensile strength as to make it uneconomical for lines of moderate or short length; likely to fracture if roughly handled; and probability of wire thefts.

16. The disadvantages of iron in comparison with copper-clad are: short life in atmospheres laden with sulphurous smoke or excessive moisture; progressive loss of tensile strength and conductivity with age; difficulty of maintaining good joints in old wire; and weight so related to conductivity as to make it uneconomical for lines of moderate or great length, in comparison with copper.

17. The corresponding advantages of copper-clad are: tensile strength and conductivity so related as to make it more economical for lines of moderate or short length than copper or iron; more economical for long lines, if repeaters can be used, than copper without repeaters; electrical properties as constant as those of copper; greater elastic stretching under sleet and wind loads than copper or iron; and diminished electrostatic capacity when copper or iron is replaced with a smaller size of copper-clad.

18. For local or way circuits with intermediate stations distributed with fair uniformity, it may be assumed that the resistance of the intermediate relays is uniformly distributed in the wire itself.

19. The limit of duplex transmission over a circuit of given conductivity is ordinarily greater than it is with simplex transmission.

20. The limit of quadruplex transmission over a circuit of given conductivity is ordinarily less than it is with simplex transmission.

21. Quadruplex transmission commonly fails on the neutral or common side first, due to inadequate sensitiveness of the neutral relays. These relays should be wound with enameled wire. An 800-ohm relay of the Frier type gave the best results of the three types tested. The polar relays need not ordinarily be wound to more than 200 ohms. The maximum permissible E. M. F. should be employed to secure the maximum line length on any given wire.

22. The line cost will be a minimum in any given case under the following conditions:

(*a*) When the insulation resistance is a maximum.

(*b*) When the battery is distributed one-half at each terminal.

(*c*) When the terminal resistances are a minimum and equal.

23. Minimum leakage can be obtained by employing the most efficient insulator and by constant vigilance in maintenance to replace broken insulators and keep the wires free from foreign contacts. The double-petticoat type of insulator is more efficient than the single-petticoat type.

24. The cost of current supply is less from a well designed power plant than it is from gravity batteries, unless the lines terminate in an isolated locality and there are very few of them.

25. The terminal resistance can be made less with generator supply than with battery supply.

26. It is not economy to operate many lines from the same gravity battery, unless they are short. In the case of long lines it will not be economical to operate more than one line per battery. When two or more lines are operated from one gravity battery, it is not possible to adjust the relays for as small a working margin of current, without interferences, as can be commercially employed when the source of E. M. F. is constant. This applies to any battery of high internal resistance, of which gravity cells are an example.

Dispatchers Compliment Telephone

The National Convention of Train Dispatchers, recently in session, brought out the fact that no innovation ever made in railroading has spread as rapidly as the new idea of train dispatching by telephone. It is only a few years since this system was taken up, but so successful has it been in practice that it is only a question of time until the telegraph will serve only as an emergency reserve.

By a system of repeating all messages and writing them down as they are sent and delivered, the operator and the dispatcher are able to keep even a more complete record of all that transpires than if using the telegraph. Practically the only difference between the two systems is that the telephone uses direct conversation and the telegraph only written words transmitted by the comparatively slow Morse alphabet. With the telephone, the dispatcher gets in closer personal touch with every man on the road through the use of that instrument than he ever was able to do with the telegraph.

Selective Semaphore and Telephone System

By Clifford Weldon

SINCE the development of the telephone for train dispatching a need has been felt for signaling equipment which could be used and operated in connection with a telephone train wire. That is, instead of having a selector on a telephone circuit ring a bell at a way station, it was required that it should throw a semaphore arm. The Western Electric Company, a pioneer in developing railway telephone train dispatching equipment, has for some time been developing apparatus in conjunction with the Union Switch and Signal Company, to meet this particular need, and a description of the new apparatus and its uses is given in the following paragraphs:

Fig. 1.

Both steam and electric railroads offer an extensive field of use for this selectively operated semaphore in connection with the telephone system. On steam roads it will probably be used exclusively for train order work. In other words, it will be employed as an auxiliary to a regular telephone train dispatching system. When used in this way it will secure a still further saving than is now effected by the telephone.

On the average railroad equipped for handling train movements by telephone there are a number of offices along it which have to be kept open 24 hours a day, and where three tricks of operators have to be employed for this purpose merely to take care of a small number of trains during the greater part of the day. Of course, during the busy hours it would be necessary to have an operator at the station, but at night, or during very light load periods, there are numerous cases where he could be dispensed with altogether, provided the dispatcher had some other means of reaching the trains.

The train order semaphore meets this need exactly. It can be installed at any point desired along the right-of-way; the dispatcher can throw it at will just as he can call a way station. He in informed absolutely as to whether the selector which he threw operated, and when the train is stopped by this means he can get into direct touch with the train crew and give them their orders.

Since electric railways are now approaching steam railroad practice, the selectively operated semaphore will enter prominently the electric railway field. The application of the semaphore, selector and telephone equipment combined in one piece of apparatus for this class of service is obvious. Their use in this field cannot fail to facilitate the movement of trains and introduce many economies in the handling of traffic.

The semaphore can in many places be used as an auxiliary to the regular dispatching system as it can be located at sidings or at points where the expense of a station and operators is not warranted. It thus forms a safeguard to the system that does not include the human factor. It can also, of course, be used in conjunction with way stations for this same purpose, permitting the dispatcher to throw a signal to "Stop" if he, for any reason, cannot reach the operator he desires.

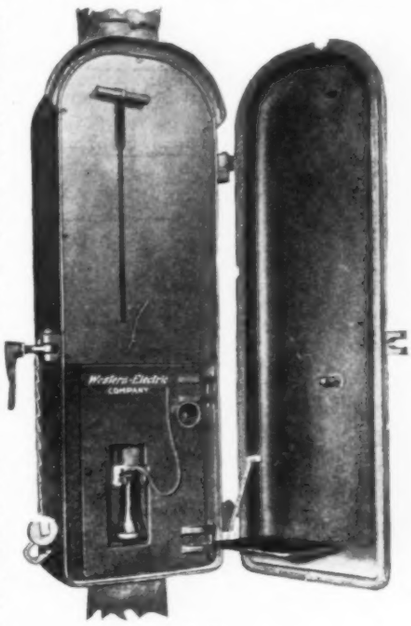


Fig. 2.

Sometimes when trains are cleared it is desired to stop them further on, such as at the entrance to a yard or at other points before they reach their next train order station. In all such cases the selectively operated semaphore forms a valuable adjunct to the train dispatching system.

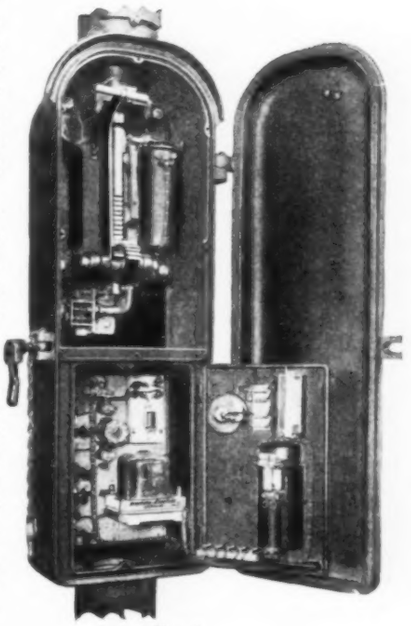


Fig. 3.

The new Western Electric semaphore has some new features which are of particular interest. In Fig. 1 is shown the outfit complete. The semaphore proper is of standard make and can be furnished in either the upper or lower quadrant types, as desired. A three-spectacle casting is provided. The semaphore, selector and telephone equipment are all mounted on the same iron post, and the apparatus is self contained. The weatherproof box is locked so that access is obtainable

to it only by means of keys which would be furnished to the proper parties. The semaphore blade itself can be furnished of any type or shape desired to conform to the practice of the railroad buying the equipment.

Everything is arranged for facilitatng maintenance work. Ample size terminals are used throughout in the apparatus, and practically all maintenance connections inside the casting are made with terminal screws or hexagonal lock-nuts. The wiring throughout is of copper insulated weatherproof braided wire, in conformance with good signal practice. All the telephone apparatus is waterproofed to withstand moisture. All wood used in the interior of the set is oil treated. The telephone and selector are enclosed in an inner compartment. All openings are arranged so that water cannot enter the set. In addition, the outer door of the set has a weatherproof gasket, rendering it practically impervious to moisture.

Fig. 2 shows the pole casting containing the signal mechanism and the telephone and selector equipment. The signal mechanism is of the electrically operated type, but is manually restored. The relay operating this is normally de-energized, and ten dry cells are required for its operation. As this relay will operate on four cells, it is obvious that an ample margin of operation is allowed.

The signal mechanism proper is contained in the compartment at the top of the casting. The only part of this which appears on the surface of the inside door is the handle of the restoring lever. The selector and terminals are readily accessible for maintenance purposes.

One important feature of the selectively operated semaphore is the fact that it gives to the dispatcher an answer-back which cannot be mistaken, telling him that one particular semaphore has completed its movement and is at the "Stop" position at the time the answer-back signal is received.

The telephone set is especially designed for railway work, and is of high efficiency. The transmitter and receiver are mounted on the outside of the inner door, on the lower part of the apparatus casting. The transmiter mouthpiece is of metal and so fastened in the set that it cannot be removed without opening the inner door. All parts are arranged so that they can be easily inspected and maintained, and they are of the usual "Bell" quality. All metal is given a black finish, which eliminates any chance of rusting.

The signal mechanism is operated by the Western Electric's latest development in railway selectors. Laboratory tests have shown that it will operate on currents ranging from 2½ to 20 milliamperes. This selector is practically independent of weather conditions and absolutely reliable. It is in operation at the present time on eighteen of the largest railroad systems in this country, where it is giving universal satisfaction.

Figure 3 shows the apparatus casting with the inside cover open. In this illustration will be seen the arrangement of the selector and terminal apparatus on the inside of the casting. The signal mechanism is shown above, together wth the manually operated lever and the gears by means of which the semaphore blade is restored to the "Clear" position. The outside door of the apparatus casting is provided with a sheet-iron writing shelf, which will be a great convenience in taking down orders from the dispatcher.

The circuit arrangements of the signaling equipment above described are very similar to our standard train dispatching circuit. The dispatcher operates selector keys in the same manner; instead, however, of a bell ringing at the point called, a semaphore blade moves to "Stop." The answer-back signal returns to the dispatcher clearly and distinctly and then he waits for the crew of the train so signaled to call in. Should he be disconnected from the circuit for any reason the crew can easily call him, but ordinarily operating practice does not require this. Only one pair of wires are needed to extend along the line. As many sets as may be desired can be connected to this circuit, and it is used both for talking and signaling. All equipment is bridged directly across the circuit, and any piece of apparatus can be taken off the line without affecting the rest of the equipment.

The use of these instruments affords an exceedingly flexible system, for as many semaphores can be located upon one telephone circuit as desired, in addition to the telephone apparatus. If desired, standard telephone apparatus can also be used at other points along this circuit where semaphores are not located. This semaphore equipment can also be placed upon existing train wires which are being operated by means of the telephone. In addition to being exceedingly flexible, the use of these semaphores insures an accurate, speedy, convenient and economical method of handling train movements.

New York Independent Project

That New York may have an independent automatic telephone system was learned when officers of the American District Telegraph Company of Brooklyn, acting, it is said, for Western interests, offered to buy all outstanding stock of the company at 80 cents on the dollar.

The company is said to have a telephone franchise. It was granted years ago. The company's business has been limited to burglar, patrol and messenger service. Tunis J. Powell, President of the company, and Henry W. Kilbourne, the Secretary, are arranging for the transfer of stock. It is reported that they are acting in behalf of J. Ogden Armour and other western financiers.

Ohio Trolley Line Equipped

The new telephone system of the Steubenville and East Liverpool traction line on the division between Steubenville and Beaver has been placed in operation. The interurban traffic of the company will be run by the telephone system, which is now used on many of the large systems throughout the country. However, in most instances, the telephone is confined strictly to single track service, and its use on a double track system such as the Ohio Valley Scenic, will prove somewhat of an innovation.

Arizona to California

Arizona is now connected telephonically with California for the first time. Persons in Tucson City talked directly with friends in Los Angeles June 17, over lines that stretch 500 miles over mountains and desert. The new lines were connected with the coast wires, and conversation held with San Francisco. To the eastward, telephone lines are being stretched and within a few weeks, it is asserted, El Paso will be within talking distance of San Francisco.

Of Interest to the Trade

By A. L. Haase

Insulation and Capacity Testing

The Thompson-Levering Company, 244 Arch street, Philadelphia, has recently brought out what appears to be one of the most efficient instruments for insulation and capacity testing that it has been our good fortune to see. Our technically inclined friends will be interested in learning more, so we briefly list some of the more prominent features.

The high sensibility galvanometer is composed of two units, one being the magnet, the second the tube with the coil system. These units are so arranged that the tube is easily removed.

The magnet is made of the finest grade of special analysis magnet steel, carefully hardened and aged. The aging of a magnet is one of the most important features, this period lasting from thirty to sixty days, during which time the multiples are watched very closely and only those of proven efficiency are used.

This little side-light illustrates in a measure a labor of pride that these manufacturers incorporate in their work, as in the most perfect bar of magnet steel different pieces cut from the same bar will take a different permanency of magnetism, which no science on earth can foretell.

The magnet is highly insulated from earth current influences by three specially constructed leveling screws of a design which admits of rapid and easy adjustment.

The system is of the ballistic pendulum type and is provided with a removable damper which can be easily placed in the coil to make the system dead beat. It has a glass window for inspection purposes, the removal of which makes the system very accessible for adjustments or the replacing of upper or lower suspensions.

The coil is clamped by a special arrangement on the back of the tube and can be made perfectly rigid during transit of the instrument, but quickly released when same is to be used.

Pure silver contact points are used throughout and are of ample size to insure a perfect contact.

The lens system consists of an achromatic objective lens and achromatic Ramsden eyepiece. The objective is especially corrected for flatness of field, a very important feature. The eye-piece consists of two lenses, achromatic eye and single field. This has been found to give the highest results.

All of the glass is the finest imported lens glass that can be purchased and is non-hygroscopic.

The scale is a copper plate reproduction of a standard millimeter scale, and is of the half-red half-black type that facilitates deflection readings.

The manufacturers can inform those interested in this excellent type of instrument more technically and we should suggest that they be written direct, mentioning this paper.

Duplex Metals Company is sending out a series of interesting circulars giving reasons why copper-clad wire should be used in telephone and telegraph work.

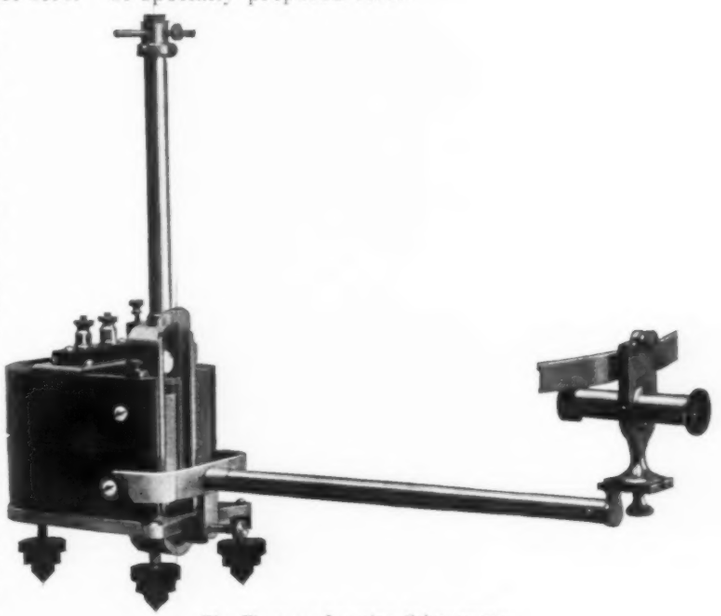
Features of the New Frankel Clip

The new Frankel testing clip is made of German silver, on account of which high transverse strength is developed. The company has been manufacturing a line of brass clips, but its engineering department, after severe tests and investigation, decided that it would be a big improvement to make the clips of German silver.

The pin, which was formerly made of steel, nickel-plated, is now being made of hardened steel, with needle point, so as to penetrate the insulation without damaging the line. The hole which this needle pointed pin makes cannot be seen except on very close examination.

Another change that was made is in the jaws, which are now so constructed as to allow an opening of fully 5/8-inch, and the teeth are made to mesh perfectly, so that they can grip and hold small wires as firmly as they do large ones.

The spring also has been strengthened, and made of specially prepared steel.



The Thompson-Levering Galvanometer.

An additional hole has been added in the bottom of the clip so that, instead of soldering the cord tips, they can be fastened by a nut and bolt, which condition offers easy changes from one cord to another.

While the company is still manufacturing the old line of brass clips, nickel-plated, these improvements which have been made in the construction and material of the German silver clip will be incorporated in its complete line.

This method of testing has been adopted by all the largest companies in the country. The largest telephone company in America has adopted this method, including all the associates of the Western Electric Company, and the United States Government is also a regular user.

Booklet on Switchboard and Receiver Cords

The Automatic Electric Co. just had printed a fine brochure on the manufacture of switchboard and receiver cords. It is printed on calendered stock and the illustrations show evidence of painstaknng effort.

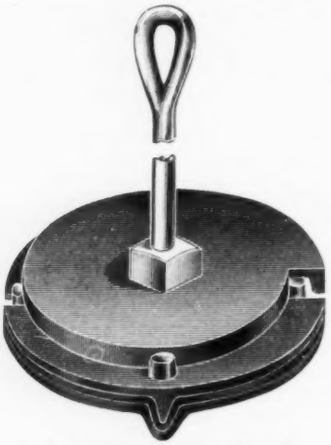
Prices are given on the standard material the company manufactures, with interesting data.

Copies are being distributed rapidly and the suggestion to write for it at once is pertinent. The book will add much to the live telephone man's data. Requests should be addressed to Dept. K, Supply Sales Department.

The Star Expanding Anchor

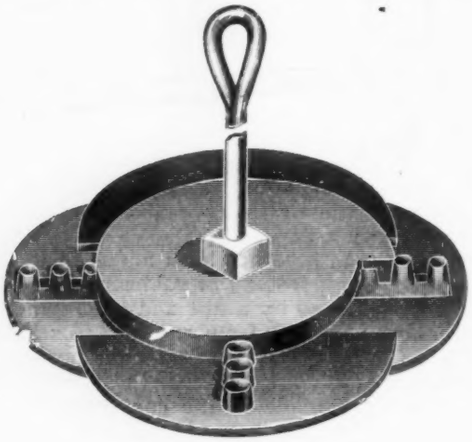
A new anchor is being placed on the market which is called the "Star Expanding Anchor," for which the makers claim that it expands four ways.

A hole is bored just large enough to allow the



Star Expanding Anchor, Closed.

closed anchor, as shown in Fig. 1, to go in. When the anchor is placed it is expanded by placing the wrench shown in Fig. 3 over the nut on the top plate



Star Anchor, Expanded.

and twisting it until the blades are at their maximum expansion as shown in Fig. 2.

The company states that one man can easily install one of these anchors complete in less than twenty minutes. Being made of malleable iron there are no weak metal parts to break; and to introduce this powerful anchor the company gives a wrench complete on the first trial order of a small quantity.

Expanding Wrench.

Prices and descriptive matter will be gladly mailed by the Miller Anchor Company, Norwalk, Ohio. Correspondents will confer a favor by mentioning this paper.

A New Telephone Factory

Announcement is made by the American Electric Company, Chicago, Ill., of its entrance into the field as a manufacturer of a complete line of telephone apparatus, which will undoubtedly prove good news to hundreds of the personal friends of the men back of the company.

This company announces that it purchased on June 20, 1911, all of the machinery, raw material, finished product, tools, dies and patents of the American Electric Telephone Company, Chicago, Ill.

The American Electric Company already has established a considerable reputation as the manufacturer of a considerable line of electric specialties, such as the Burns Adjustable Bracket, Samson Auto Horn, etc.

P. C. Burns, President of the American Electric Company, is exceedingly well known to the independent telephone operating and manufacturing trade, through having been a pioneer in the buisiness and having given his financial support and personal efforts in the fighting of many battles for the Independent cause. Mr. Burns will give his personal attention to the business.

With a personnel in the office, engineering department and factory not only chosen for their experience and ability to secure results, but taken from among the employees of the American Electric Telephone Company, assurance is felt by the management that they can best meet the needs of those who have been customers of the American Electric Telephone Company.

The company will occupy the splendidly equipped American Electric building, occupying the block at State and Sixty-fourth street, and gives assurance that ample financial resources are back of the concern to guarantee the permanency of the institution, and the fulfillment of all of the agreements.

We feel sure that the operating field will agree with this paper in wishing the new company abundant success in its undertaking.

Guarding Against the Fire Hazard

The telephone is a public necessity. In the case of interruption to telephone service, especially in larger cities business is seriously handicapped and very nearly comes to a standstill. It is, therefore, necessary that extra precautions be taken to avoid any possibility of a fire starting in a telephone central office exchange.

The insurance problem before a telephone exchange manager is twofold:

1. To insure against an actual fire loss.
2. To insure against the public's loss of telephone service due to fire.

While the regular form of fire insurance will be ample for the first, the best protection to the telephone exchange manager for the second is to purchase an equipment in which fires are not likely to start, or if they do start, can be readily controlled.

The Western Electric Company has made a thorough study of fire hazards and has designed its central office equipments with the prime object in view of reducing such hazards to a minimum. The following are some of the features of telephone central office equipments that are in the nature of fire preventives:

In the first place, it is customary with the Western Electric Company to furnish a power protection panel for installation at the entrance to the power mains in the telephone exchange building. The character of the apparatus mounted thereon is dependent on the kind of power circuit used. In general, lightning arresters, fuses and service switches are mounted on a slate base, thus effectively preventing any fires from starting in the exchange due to lightning discharges, crosses with high potential circuits or the drawing of excessive current overloads from the service mains.

In a telephone central office equipment, current is required for many purposes, such as for lighting the switchboard signal lamps, the operating of relays, and the operation of transmitters, receivers and the signal bells. Several kinds of current are required. The current for all purposes other than the ringing of subscribers' bells is generally 24 volts direct current, whereas the ringing current is generally from 75 to about 150 volts alternating current. Numerous other kinds of currents are often made use of, as, for example, currents of different high frequencies for tone test, trouble test, etc.

These various kinds of currents are obtained by means of motor generators or converters operating from the service mains. In a large central office equipment there are many thousands of pieces of apparatus which must be supplied with these different kinds of currents. In order to supply these currents properly to the apparatus, it is necessary that there be some common distribution point. It is the practice of the Western Electric Company to do this distribution from a fuse panel, as shown in Fig. 1. This fuse panel consists of slate panels reinforced with iron braces. Every current carrying lead running from this fuse panel contains an individual fuse. These fuses are of the alarm signal type, so arranged that in case any one of the fuses blows a loud bell will start ringing and continue until the fuse is removed or replaced. In addition to this alarm the Western Electric fuse panels have two unique and distinctive features, by means of which the attendant can not only locate at a glance the par-

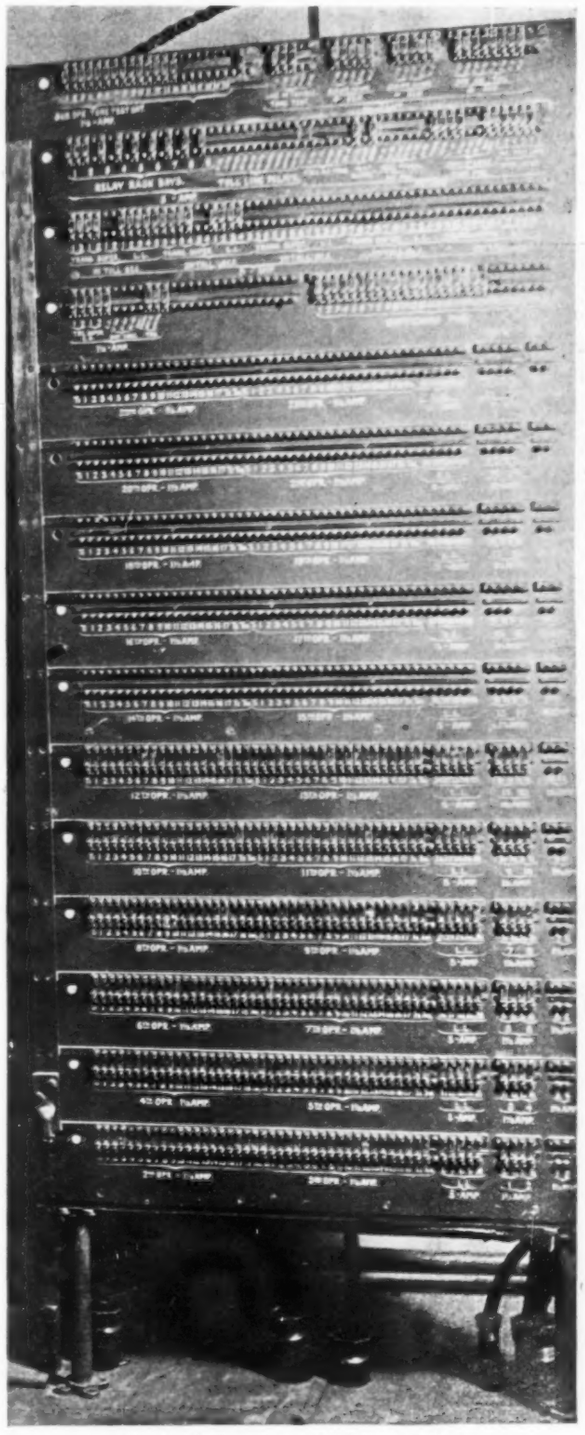


Fig. 1. Fuse Panel with Alarm Signals.

ticular bar in which any fuse is blown, but, in addition, he can locate the very fuse itself. The method of doing this is simple, and is as follows: When the attendant is notified of a blown fuse by the ringing of the gong, he goes to the fuse panel to locate and clear the trouble. Each horizontal busbar is provided with a small signal lamp, as shown in Fig. 1. When a fuse blows, the corresponding lamp is lighted, and this shows the attendant in just which fuse bar the blowout occurs. In addition, the fuses themselves contain a glass bead on the end of an arm, which is elevated from the face of the fuse panel when the fuse itself is operated. Thus the attendant, after having

Fig. 2. Fire Screen, Protection Panels and Bulkheads Between Switchboard Sections.

his attention called to the proper busbar, is further directed to the very fuse that has blown.

Another distinctive feature of Western Electric design is that the safe carrying current of each piece of apparatus and wire has been predetermined and the current distributing leads are so apportioned that it is impossible for any piece of apparatus in the switchboard to draw from the source of current supply at the busbar more current than can be safely dissipated, even in case of short circuits, grounds, etc.

It is Western Electric practice in nearly all cases not to permit of more than 1 1/3 amperes in any one circuit running to the switchboard. In the terminal room, however, where the fire hazards is not so great, are other pieces of apparatus mounted which are permitted to take as high as 5 amperes. No fuses greater than 5 amperes are used for the telephone equipment proper. In order to secure a maximum degree of safety, the Western Electric Company has adopted the practice of making the 5 ampere fuses with a narrow slot that can only be mounted on a size No. 6 screw post, and also the 1 1/3 ampere fuses with a wide slot for a size No. 10 screw post. Thus it is impossible for an attendant through error, to mount a 5 ampere fuse on a circuit that is only designed to carry 1 1/3 amperes.

In order to have the circuits running to the switchboard carry no more than 1 1/3 amperes, it is necessary to increase the number of circuits. For example, for many years this company has followed the practice of running an individual lead to each individual cord circuit. This practice is quite costly, but it is highly desirable from an operating company's standpoint, because it not only decreases the fire hazard, but, in addition, it lessens the chance of a full operator's position being put out of commission by the blowing of a single fuse. With the present arrangement, if any one fuse blows, it simply puts the one associated cord out of business and the operator still has her remaining cords in perfect condition.

Another fire hazard is the possibility of lightning or high potential current entering the telephone exchange over the telephone wires. Each individual subscriber line is equipped with two fuses, generally located in the cable box, but sometimes located in the exchange; with two heat coils for protection against any sneak current that might do injury to the telephone apparatus due to a continual flow; and also a set of carbon cutouts for protection against lightning or other high voltages. These protectors are all connected to a common ground, and are made with extreme care so as safely to conduct the lightning or high potential currents to this common ground.

Another fire hazard is in the cross connecting wire on the main distributing frame. It is the general practice to have the outside telephone lines connected to the terminal side of the main frame and thus any lightning or high potential currents that enter over these lines must pass through the cross connecting wire of the main distributing frame to the protectors. It is the practice of the Western Electric Company to use a wire that is flame-proof and has a very generous coating of rubber insulation for making connections between the terminals and protectors.

All known means of making further protections against the possibility of fire are taken, as will be noted from the following:

All of the cables connecting the switchboard with the various frames are covered with a layer of lead tape, which is a direct protection against fire and also an indirect protection in that it keeps moisture out of the cable, thus preventing possible short circuits. It also prevents rodents from gnawing through and short circuiting some of the conductors. Furthermore, all of the cable is thoroughly covered with a fire resisting paint which guards against the attack of any flames from without the cable.

The entire front and rear lighting circuit is run in flexible metallic conduit fastened securely to the inside of the switchboard sections by galvanized iron pipe clamps. At each operator's position a cast-iron junction box is provided. The No. 14 B. R. C. twin wire is

never exposed to any telephone wire or given the least chance to become crossed or grounded. At the head of the switchboard there is also placed a cutout box which contains plug fuses of such current carrying capacity that the wiring is amply protected. In this lighting circuit wiring the Western Electric Company conforms to requirements of the National Board of Fire Underwriters by not putting more than 660 watts on any one circuit.

The fire hazard in the apparatus itself has been greatly lowered in the Western Electric apparatus by the substitution of enameled wire in place of silk covered wire. This enamel insulation will stand a heat many times over that which would completely consume the silk insulation.

It is recognized that even with all the above mentioned precautions there is a possibility of fire starting in a switchboard section, due primarily to carelessness on the part of attendants, whereby flames may be started by soldering irons or sparks from temporary short circuits, etc.

Western Electric switchboards are equipped with several unique features that would tend to confine a fire to the space in which it started. By reference to Fig. 2, a steel fire screen will be noted extending from the face to the rear of the switchboard for its entire length, which would effectively prevent any fire starting in the lower part of the board from reaching the multiple above and putting the entire system out of commission. You will further note fire protection panels located directly beneath this fire screen. These panels are made of a fire-proof material known as "Transite," which effectively prevents a fire starting in the apparatus below from reaching the answering jack cables or outgoing trunk cables. The ends of the sections are equipped with bulkheads that partly separate one section from that of the adjoining section in order to prevent a fire from extending laterally from one section into the adjoining section.

It is on account of these extreme precautions, observed by the Western Electric Company in the design of its equipment, that one very seldom hears of a switchboard fire starting in a central office equipment of this make.

Western Electric Company Business

The business of the Western Electric Company for May showed a very satisfactory recovery from the April depression, when gross sales for the first time in many a month showed a comparative decline from the same month of the previous year. May's gross business was 12 percent in excess of the same month a year ago and for the five months to June 1 sales have exceeded the same period of 1910 by eight percent. This means a gross business for the full fiscal year if maintained of between $70,000,000 and $71,000,000.

At the end of May the company was employing 26,000 men, compared with 25,000 two months ago and 23,464 at the beginning of the fiscal year. It is interesting to note that when business was at the top in 1907 the company had a total of 29,000 employees, or ten percent more than at present, although the volume of production for that year was between four percent and five percent less than this. Increased efficiency of operation explains the difference.

The company is concentrating operations at its big Hawthorne plant near Chicago. Illustrative of the splendid labor market which the company possesses both in New York and Chicago is the fact that in 1910 the company examined 175,000 applicants for work of whom 35,000 were given a trial with the result that 3,500 were retained in permanent positions.

Ironite Drop Wire

At first blush the uninformed person might think that drop wire is drop wire, and let it go at that. Yet, while considering a telephone plant as a whole, the item of drop wires may seem an unimportant thing; in detail they are extremely important, and it is attention to details that makes efficiency.

It is true that almost any old wire can be used for drop wire with temporary and evanescent success. It is also true that material is sold sometimes for drop wire which is scarcely any better than any old wire.

We are even forced to report that some misguided people sell drop wire in coils which—whisper it—are over ten per cent short of their supposed length.

So you see it pays to give attention to these things. When you order drop wire specify the kind you want and select the kind you know is good and on the square. For instance, there is Ironite duplex drop wire. The Paragon Sellers Company, which handles it, says it costs less than ordinary twisted pair wire, yet has much greater strength and insulation resistance—insuring freedom from breakage and sag. To prove its claims the company offers to send samples to any one who will write for them to 170 Fifth avenue, Chicago.

A Clever Improvement

The Waage Electric Company, 670 West Madison street, Chicago, has submitted us circular matter describing a clever improvement in its electric soldering irons.

This new soldering iron, instead of having a solid copper resistance element which would oxidize rapidly and shorten the life of the tool, has a specially designed

The Waage Soldering Iron.

lava element which is non-oxidizable and non-corrosive; stays hot all the time current is on and by a closer relation of the element to the working tip keeps the iron at perfect working heat all the time.

The simplicity of this arrangement has reduced the price of this favorite make of iron, not only in first cost but in repair charges.

By the use of this copper-wound lava resistance

element a much lower current consumption is effected.

The tool is claimed to be from 2 to 5 inches shorter than any other make, making it easier to handle and it is said no grounding or burn-outs from dropping the iron are possible.

Interested users of this type of tool will receive full information direct from the company by mentioning TELEPHONE ENGINEER.

Stromberg-Carlson's New Chicago Office

Following the sale of its Chicago building the Stromberg-Carlson Telephone Manufacturing Company is located in the Continental building, 708-710 West Jackson boulevard, just one block west of its former location.

The company has a large improved office and stock room space on the first floor and basement with efficient shipping facilities. There is a finely equipped sample room in which principally telephones of all kinds will be carried in stock subject to immediate shipment. The same complete and newly replenished stock will be carried in the new headquarters as in the old, consisting of local and common battery telephones of all types, telephone and switchboard parts of all kinds, aerial and underground cable of standard sizes and wire construction material, linemen's tools and accessories of all kinds. A. M. Haubrich is manager of the office.

Schuchardt & Schulth, New York, are calling attention to their hand tachometers. The S. & S. tachometer indicates directly the speed of rotation of any shaft in r. p. m., and also the peripheral speed of belts and wheels in feet per minute. These instruments are practically a necessity wherever any kind of machinery is used.

Some very interesting literature is being issued by the Murphy Electricity Rectifier Company, Rochester, N. Y. The company has perfected, after many years of experimental and development work, a new type of rectifier for charging storage batteries from alternating current.

Lindsley Brothers Company, Spokane, Wash., has issued a handsome little booklet on "Cedar Poles," giving the history of the pole business, the special claims for the Lindsley "Pole Cat" brand of poles, and valuable tables for users.

Minnesota Electric Company has issued a booklet describing the Chapman lightning arrester for telephone and telegraph lines. Its claims are that it is absolutely weatherproof and will withstand the heaviest lightning discharges.

Page & Hill Company has installed an electric lighting system at its Minnesota transfer yard and put on a night shift, business compelling work night and day.

Every telephone man should have a copy of the Brookfield Glass Company's 1911 catalogue of glass insulators.

Brevities of the Business

PERSONAL NOTES.

We regret to note the death at Seymour, Conn., of William Richard Brixey, one of the leading manufacturers in the field of insulated wire and cables. He was born at Southampton, England, May 11, 1851, educated at a well known grammar school and then entered the British Mercantile Marine service, commanding his own ship and visiting all the leading ports of the world. He came to this country in 1878, became at once an American citizen, and went into business with his brother-in-law, A. G. Day, a pioneer in the American rubber industry and the inventor of Kerite. In 1879 he married Miss Frances N. DeWolfe, daughter of Alva G. DeWolfe, a co-worker of Mr. Day's and also an inventor of some note. The Day plant was at Seymour, Conn., and there Mr. Brixey developed the business with remarkable energy and intelligence, mastering it in every detail and becoming general manager on the death of Mr. Day, and sole proprietor upon the death of his sister, Mrs. Day. Mr. Brixey was not satisfied with the use of his cables in the telegraph and telephone field, or with the early endorsement of such men as Morse, but pushed out into larger developments in other fields; some of the noteworthy of these included the supplying and laying of the Alaskan cable; the furnishing of the Panama zone cable, and the furnishing of the wires and cables for the Pennsylvania tunnel and terminal connecting the two shores of the Hudson and East rivers. In 1908 Mr. Brixey incorporated the business as a company and soon after retired, leaving it to the management of his eldest son, Richard D. Brixey, president of the Kerite Company. Mr. Brixey left two other sons, Reginald W. Brixey, vice-president, and Austin D. Brixey, secretary of the company. Mr. Brixey was quite active in public life, being a member of the American Institute of Electrical Engineers, and a member for many years of the Old Guard of New York City with the rank of captain. He was a member of the Brooklyn Club and a high degree Mason. In politics he was a staunch republican. At the time of the terrible subway explosion at Murray Hill, New York, in 1902, he was very seriously injured by glass blown into his room at the adjacent hotel. His wonderful constitution, however, pulled him through injuries of a most serious character, though these probably undermined his health, which had always been of the best. Mr. Brixey's wife died in 1909 and he is survived only by the three sons above mentioned. He was a man of sterling qualities and of unusual generosity. His death will be sincerely regretted by all who knew him.

Rollo R. Stevens, Columbus, Ohio, for several years division sub-license agent of the Central Union Telephone Company, has been appointed by the American Telephone and Telegraph Company agent for the connecting companies in Ohio. During his connection with the Central Union Company he has been concerned in all the agreements made in that time for connecting the toll lines of the Central Union and American Telephone and Telegraph Company with independent exchanges.

A. S. Bean has been chosen secretary and general manager of the Exchange Telephone Company of De Kalb. Mr. Bean announces that his company will make extensions as rapidly as possible and it shall be the policy to cover the telephone field in that vicinity.

W. T. Friganza, formerly superintendent of the Hone Telephone Company at Mound City and Mounds, has been appointed manager of the Bell Company at Cairo.

Henry H. Sykes, general manager of the Southern New England Telephone Company, died at his home in New Haven, Conn., May 18.

John E. Scott, division manager of the Michigan State Telephone Company, at Lansing, has been promoted to the position

of traffic chief for the Grand Rapids district, with headquarters at Grand Rapids.

Chester C. Failing, district manager of the Michigan State Telephone Company at Port Huron, has been promoted to the office of district plant chief with headquarters at Saginaw. Mr. Failing will still maintain his residence in Port Huron for the present, although his office business will be transacted in Saginaw. This promotion comes in recognition of his ability and faithful service in the interest of the company.

Guy S. Lytle has been appointed inspector of telephone train dispatching and block signaling for the Northern Pacific, with headquarters at St. Paul. The telephone is now in operation on the system generally, there being about 200 telephones against about 1,300 telegraphers.

James B. Brown, vice-president of the National Bank of Commerce, and Sam P. Jones, president of the Commercial Bank and Trust Company, Louisville, Ky., have been elected directors of the Louisville Home Telephone Company, succeeding P. S. Pogue and S. M. Heller, who have retired from the board. Mr. Pogue will continue as general manager and Mr. Heller will continue to act in the capacity of assistant treasurer.

P. R. Ridgely has assumed his position as acting general manager of the Bell Telephone Company, St. Louis, having succeeded Edward F. Carter. Mr. Ridgely has been with the company since 1901 and his promotion has been rapid.

Rodger F. Carney, manager of the Helena exchange of the Rocky Mountain Bell Telephone Company, has assumed the management of the company's exchange at Great Falls. Mr. Carney will be succeeded at Helena by L. L. Gourley, who has been connected with the Helena exchange in the capacity of city salesman.

W. R. McGovern, chief engineer of the Wisconsin Telephone Company, who has been connected with the company for the past twelve years, has accepted the position of special engineer on plant work with the Chicago Telephone Company. He will be succeeded by W. D. Hobbins.

J. L. McCurdy, manager of the Home Telephone Company, Weatherford, Texas, has resigned his position to accept the management of the Independent Telephone Company of Fort Worth, Texas.

J. M. Knapp, of Buffalo, has been appointed general manager of the Friendship Telephone Company, the company which recently took over the Onondaga Telephone Company of Syracuse and the Home Telephone Company of Utica.

A memorial in honor of Alexander Graham Bell will be erected at Brantford, Ont., his birthplace. The ceremony will take place on Dominion Day, July 1, 1912.

A. L. Fulenwider has been elected president of the People's Home Telephone Company of Birmingham, Ala., which has recently changed hands. He has been connected with the old company for the past three years in the capacity of director and has had much to do with its success up to this time.

William Underwood, a graduate of the Forestry School, University of Minnesota, and an expert in wood preservation, has been secured by Page & Hill Company to take charge of their pole preserving plant at Minnesota Transfer.

George R. Fuller, president of the Rochester Telephone Company, Rochester, N. Y., has been elected vice-president of the Rochester, Syracuse and Utica Telephone Company recently organized.

James B. Douglas, manager of the Bell Telephone Company at Dayton, Ohio, died in that city on June 3 after a lingering illness of two years. He entered the employ of the Bell Company in 1895, having served the company in the capacity of manager successively in Tiffin, Gallipolis, Circleville, Alliance and Dayton. He leaves a wife and one son.

Murray G. Geddes, who has been in charge of the material department of the Nebraska Telephone Company at Beatrice, Nebr., has been promoted to the position of wire chief for the company at Tecumseh.

Wesley R. Ellis, of Ashtabula, Ohio, has been appointed manager of the People's Telephone Company at Geneva and will assume his new duties at once. Mr. Ellis is a graduate of Cornell and has fine technical training. He was manager of the Bell Telephone Company at Johnstown, Pa., for four years, and has been with the Ashtabula company for the past two years.

George Wymer, chief of the Central Union Telephone Company's exchange at Portsmouth, Ohio, has been promoted to the position of district wire chief, District No. 4, with headquarters at Newark.

L. C. Pershing, Mahanoy City, Pa., has been appointed manager of the United Telephone Company's office at Chester.

J. W. Bernor, Smiley, Texas, has been appointed manager of the Gonzales Telephone Company, Gonzales, succeeding J. M. Murphy, who has been manager of the company since its organization a number of years ago. While Mr. Murphy retires from the active management of the company, he still retains his interest in the concern and will continue to direct the policy of the company, which is one of the largest independent telephone companies in that section.

R. C. Kimbrough, formerly local agent of the Southwestern Telegraph and Telephone Company at Tyler, Texas, and later district commercial agent with headquarters at Marshall, has taken a position in the general office of the company at Dallas.

Edward P. Gray, for a number of years district wire chief of the Wisconsin Telephone Company, with headquarters at Racine, has been promoted to the position of district plant chief, one of the most important positions of the company. The company has divided the system in four districts, namely, Milwaukee, Eau Claire, Madison and Green Bay. Mr. Gray will have charge of the Eau Claire district.

E. J. Clapp, formerly assistant general manager of the Interstate Independent Telephone and Telegraph Company, Aurora, Ill., died suddenly at Newton, Ill., June 2. Mr. Clapp formerly lived at Newton, but for some time has resided at Warren, Ohio, and was in Newton on a business trip when his death occurred.

Michael I. Pupin, professor of electromechanics in Columbia University, has been appointed to serve as director of the Phoenix Research Laboratories, in which capacity he will have general charge of the development of the research work in the department of physics.

Walter W. Nicholson, Syracuse, N. Y., division manager for the Rochester, Syracuse and Utica Telephone Company, has been promoted to the position of president of the company. Mr. Nicholson has been associated with the Bell Company in various capacities since 1881.

Edward N. Crane, president of the D. Van Nostrand Company, of New York, died at his home, Newark, N. J., June 14, of acute indigestion. Mr. Crane was a director of the Franklin Savings Institution and a member of the New Jersey Historical Society, the Newark Museum Association, the Cateret Book Club and the Engineers' Club of New York. He was president of the board of trustees of the Park Presbyterian Church and was prominent in church work.

Harmon M. Sage, assistant superintendent of the Western Electric Company at Hawthorne, died on May 31. He had been with the company twenty-eight years.

C. A. Reed, Columbus, Ohio, recently promoted from general superintendent of the Ohio division of the Central Union Telephone Company to the general superintendency of the plant, which includes properties in Ohio, Indiana, Illinois, Wisconsin and Michigan, was tendered a banquet at the Southern Hotel, Columbus, by seventy-five Ohio officials of the company.

Justinis Helgren, of Omaha, has assumed the duties of district superintendent for the Nebraska Telephone Company, with headquarters at Norfolk.

W. H. Dean, traffic manager for the Bell Telephone Company at Beatrice, Nebr., has been transferred to Duluth, Minn.

John Leisenring, signal engineer of the Illinois Traction System, Peoria, Ill., has been placed in charge of the overhead department of the company, including the transmission line, telephone lines, automatic signals and Blake signals and trolley wire.

Fred A. Allen, chief night operator for the Southern New England Telephone Company, died at New Haven, Conn., June 19, after a short illness. Mr. Allen was the first operator in the New Haven exchange and as this was the first exchange established in the world, he had the record of being the oldest operator working on an exchange board in the world. He was in his fifty-third year.

W. B. King, at one time president and general manager of the Pacific States Telephone Company, died in Portland, Oregon, May 6, at the age of sixty-eight. He resigned his position about twelve years ago, after disposing of his stock in the company.

Alonzo Burt of Milwaukee, for the past ten years president and manager of the Wisconsin Telephone Company, has been elected vice-president and general manager of the Chicago Telephone Company at a salary reported to be $15,000 a year. Mr. Burt has been in the business for the past twenty years, during which time his advancement has been rapid, as he enjoys the distinction of having risen from a position as collector at $8 per week.

NEW TELEPHONE COMPANIES.

BARLING, ARK.—The Citizens' Telephone Company, which was recently organized at this place, will be incorporated.

DENVER, COLO.—Articles of incorporation have been filed with the secretary of state for the Rockland Telephone Company of

Jefferson county with a capital stock of $10,000. The incorporators are G. W. Morse, R. V. Lloyd, Fred T. Shultz, all of Jefferson county.

PUEBLO, COLO.—The Pueblo Southeastern Telegraph and Telephone Company has been incorporated with a capital stock of $50,000. The incorporators are W. D. Garwood, B. H. Tallmadge, John H. Voorhees.

WASHINGTON, D. C.—Articles of incorporation have been filed for the Richey Telephone Lock and Call Register Company; capital stock $100,000. The incorporators are C. V. Richey and E. H. Booth, Washington, D. C.; R. T. Ward, Baltimore, Md.

PULASKI, ILL.—The Pulaski Telephone Company has been incorporated with a capital stock of $2,500 by H. B. Eshleman, James M. Palmer, E. J. Laskey and J. B. Kennedy.

HUDSON, ILL.—Articles of incorporation have been filed for the Hudson Telephone Company with a capital stock of $2,000. The incorporators are W. P. May, Maro B. Farwell and Floyd May.

CHICAGO, ILL.—The Rebuilt Telephone Equipment Company has been incorporated with a captal stock of $2,500 for the purpose of dealing in telephone apparatus and equipment. The incorporators are Edward C. Stoeffhaus, Philip L. Sullivan, William J. Maher, Frank T. Sullivan.

WASHINGTON, IA.—The Glendale Telephone Company was recently incorporated in Washington with a capital tock of $2,700, and the officers are as follows: President, J. C. F. Wead; vice-president, John S. Wilson; secretary, W. M. Galloway; treasurer, G. Juzeler.

COIN, IOWA.—The Coin and Yorktown Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are E. T. Statton, J. C. Scheibenberger and others.

ELDORA, IOWA—The Bear Creek Valley Telephone Company has been incorporated by J. W. Miller, George Nigan and A. C. Brassfield.

CLEGHORN, IOWA—The Epworth Rural Telephone Company has been incorporated with a capital stock of $600 by E. H. Mitchell, W. J. Bryant and Lee Walters.

LAKE MILLS, IOWA—The Center Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are M. T. Peterson, P. J. Jensen, A. A. Fruiten, L. Rollifson, M. J. Stedje, O. L. Dahlen and T. N. Truile.

RUSSELVILLE, IND.—The Citizens' Co-operative Telephone Company has been incorporated with a capital stock of $4,500 by R. Boyd, W. Baine, D. L. Watkins.

GENEVA, IND.—The Star Telephone Company has been incorporated with a capital stock of $1,200 by Charles Duer, W. R. Mann, L. M. Fogel and Martin Reef.

LINTON, IND.—Articles of incorporation have been filed for the Fairview Mutual Telephone Company with a capital stock of $5,000, for the purpose of installing and operating a telephone system in the western part of Greene county. The incorporators are George Sharp, John Berus, Ira E. Adams, and Mack Ellis, all of Linton.

WISNELL, KY.—The Harris Grove and Murray Independent Telephone Company has been organized by M. B. Guthrie, J. F. Key, J. B. Boyd, F. O. Key and C. Barnes.

GILSTRAP, KY.—The Butler County Mutual Telephone Company has been incorporated by Eugene White, J. E. Morris, C. W. White and E. P. Stewart with a capital stock of $725.

AUGUSTA, MAINE—The Randall Telephone Manufacturing Company has been incorporated with a capital stock of $1,500,000.

LONG GREEN, MD.—The Long Green Telephone Company has been organized and the officers are as follows: President, O. P. Grau; vice-president and treasurer, J. H. Priegel; secretary, C. E. Goder.

DETROIT, MICH.—The Detroit Automatic Telephone Company has been incorporated with a capital stock of $250,000. The incorporators are Dr. Leopold F. Mueller, Charles R. Chisholm and Otto Van Humrich. The purpose of the company is the manufacture of a new style, primary current direct connection telephone, the invention of Dr. Mueller. Plans are being devised for the erection of a large factory in Wyandotte, Adrian or Detroit.

LESLIE, MICH.—Articles of incorporation have been filed for the Leslie Rural Telephone Company with a capital stock of $10,000.

ST. JOHNS, MICH.—The Clinton Telephone Company has been incorporated with a capital stock of $20,000.

KALAMAZOO, MICH.—Articles of incorporation for the Climax Citizens' Telephone Company have been filed with County Clerk E. F. Curtenius. The capital stock is $6,000.

DIMONDALE, MICH.—A new telephone company has been organized at this place by E. A. Lundberg, T. S. Reynolds, John Hull, C. S. Hutt, Frank E. Phinney and Benjamin Fry.

BAGLEY, MINN.—The Clover Telephone Company has been incorporated with a capital stock of $25,000; incorporators, C. R. Bailey, Oscar Barnes and M. J. Kolb.

HENNING, MINN.—Articles of incorporation have been filed for the Henning-Vining Telephone Company, capital stock, $4,000. The officers of the company are as follows: President, Arnt Monston, Henning; vice-president, L. Bendickson, Henning; secretary and treasurer, Melvin Lund, Vining. The company will construct telephone lines in the vicinity of Henning and Vining.

ASHBY, MINN.—J. H. Bemis, H. O. Peterson, L. J. Hauge and others have incorporated the Ashby Telephone Company with a capital stock of $2,000.

DETROIT, MINN.—Articles of incorporation have been filed for the Floyd Farmers' Telephone Company. The capital stock is $9,000 and the incorporators are as follows: Thomas A. Doherty, Andrew P. Johnson, Byron L. Wheeler, C. J. Kuehl and Gust Larson.

SPRING GROVE, MINN.—The Spring Grove Telephone Company has been incorporated by O. Heogh, J. C. Grau and C. J. Schansberg with a capital stock of $2,000.

MAINE, MINN.—The Maine-Star Lake Telephone Company has been incorporated with the following officers: President, C. E. Bingham; vice-president, Chas. Johnson; secretary and treas., Aug. Sandberg. The capital stock is $4,900.

CRANE, MO.—The Crane Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are H. B. Boyd, G. W. Woodford, E. W. Cristie and others.

CURTIS, NEB.—The Curtis Telephone Company has been incorporated with a capital stock of $5,000.

BLUE HILL, NEB.—Articles of incorporation have been filed for the Glenwood Telephone Company with a capital stock of $1,980.

TAYLOR, NEB.—The Farmers' Telephone Company has been incorporated; capital stock $10,000.

WEVERTS, NEB.—Articles of incorporation have been filed for the Farmers' Mutual Telephone Company.

WAUNETA, NEB.—The Wauneta Farmers' Telephone Company has been incorporated with a capital stock of $24,000.

ESSEX, N. Y.—The Bauquet Telephone Company has been incorporated with a capital stock of $4,000. The incorporators are as follows: Charles C. Stafford, Essex; Frank E. Bigelow, Albert F. Cook, Arthur Flack, Myron Tynell, William E. Atherton, Wallace W. Richards, Whallonsburg.

Articles of incorporation have been filed for the Morrisville Telephone Company with a capital stock of $20,000. The directors are: Ernest C. Newton, Dora M. Newton, Fred S. Harwood, Brownell Tompkins, Edwin N. Dexter, Morrisville; Parker Newton, Minnie Newton, Earlville.

NEW YORK, N. Y.—The Chisholm Transmitter and Telephone Instruments Company has been incorporated with a capital stock of $750,000 for the purpose of manufacturing and dealing in telephone instruments, etc. The incorporators are T. E. Wing, P. W. Russell, B. D. Wheadon, R. Bennett, New York City; M. V. Warner, Elizabeth, N. J.

OSWEGO, N. Y.—Articles of incorporation have been filed for the Oswego Telephone Company with a capital stock of $100,000. It is stated the new company is organized in protest against a proposed increase of rates by the operating company.

MOTTVILLE, N. Y.—The Mottville Telephone Company has been incorporated by John W. Brown, Flora B. Brown, Michael J. Hackett, Daniel E. Sheldon and Willis J. Moreland, Mottville; John L. Shultz, Skaneateles; James H. Huxford and Thomas F. Powers, Skaneateles Falls.

MAXVILLE, OHIO.—The Maxville Telephone Company has been incorporated with a capital stock of $10,000 by S. S. Mouler, George Vanatia, John Beil, James H. Goodlive and Herman A. Wilson.

GUILFORD COLLEGE, N. C.—Articles of incorporation have been filed for the Guilford Telephone Company with a capital stock of $8,000. The incorporators are D. W. Lindley, Lee S. Smith and others.

CONVENTIONS.

The North Dakota Independent Telephone Association will hold the sixth annual convention at Bismarck, North Dakota, August 15 and 16.

The Mississippi Independent Telephone Association will hold its annual convention at Rainey Hotel, New Albany, Miss., July 17 and 18.